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INDUSTRY, RESEARCH AND EDUCATION IN GREAT BRITAIN

IT was one of the merits of the annual reports of the Department of Scientific and Industrial Research that they afforded something of the nature of an annual stocktaking of the research effort of Great Britain. The broad surveys which appeared over the signature of successive chairmen of the the Advisory Council, such as Lord Rutherford and Lord Riverdale, rarely failed to point not merely to achievements but also to directions in which further efforts were required. Although the War has interrupted this fruitful and effective method of encouraging research-mindedness, noteworthy efforts at education have been made in this field during recent months. Debates on economic policy demonstrated a widespread realization in the House of Commons that adequate research must be the foundation of an expanding export trade. Dr. P. Dunsheath's lecture to the Royal Society of Arts on "Industrial Research in Great Britain: A Policy for the Future" is only one of a number of occasions when the whole structure and policy of industrial research has come under review.

Two of the most notable have been the debate on scientific research in the House of Lords on July 15 and 20 and a memorandum on the meaning of research for industry prepared by Sir Harold Hartley. Sir Harold Hartley affirms his belief that industrial research will be the vital factor in determining the future prosperity of Great Britain, and his paper is a plea to industry to accept the help which science can give, and for more industrialists to become research-minded. Despite some outstanding exceptions, there has not been in Great Britain a general appreciation of the value of science in industry, and the expenditure on research has been correspondingly less than in Germany or the United States of America. While British men of science have proved in both the world wars that they can more than hold their own if they are given equal facilities and support, it is impossible to avoid the conclusion that if Great Britain is to maintain its position in the world markets, industry must give greatly increased attention to research as soon as the progress of the War makes it possible. Industrialists should be taking active steps now to organize this aspect of their post-war activities.

This same point is well made in an article on "Foundations of Prosperity" in the *Round Table*. On the technical side, it is pointed out, the failures of industry have come mainly from inadequate support of scientific research and from unwillingness or inability to scrap obsolete plant. That is one reason for the concern which has been expressed regarding recent pronouncements as to the post-war policy of the British motor-car industry; these statements have aroused doubts as to whether the policy is sufficiently bold and forward-looking and not too tied to pre-war ideas, and reluctant to replace out-of-date plant. As a nation we still present a curious contrast between the most outstanding

individual achievement in every branch of science, and a certain suspicion and scepticism concerning the practical value of the scientific approach to industrial problems. There are still managements and workers in the iron and steel and engineering industries whose belief in traditional practices constantly obstructs the use of metallurgical or physical knowledge. Lord Listowel has solid ground for his assertion that full employment and better conditions of life after the War largely depend on our capacity to modernize industrial equipment and processes and to improve the quality and quantity of their output, checking the failure to keep abreast of the times which has characterized some fields of industry.

On this question of obsolescence the *Round Table* article makes the important suggestion that while neither Government nor industry alone can provide a remedy for such technical deficiencies, the Government contribution should not only include raising the standard of education and the promotion of scientific research, in national institutions and in the universities as well as by industrial concerns, but also by devising a system of taxation which will encourage instead of penalize the modernization of equipment. There is no more urgent task in administration than the reform of the principles of inland revenue. Taxation has come to be looked on departmentally as an end in itself, and until that notion is killed and the corpus of statutes and interpretations built up around the income tax over a century, and more is swept away and replaced by principles more in accord with the facts and requirements of modern life, it will remain true that the industries most in need of modernization are those least able to afford it.

Sir Harold Hartley's memorandum is strangely silent on this important point; but, almost simultaneously with the *Round Table* article, the *Economist*, in its centenary number, lends powerful support from another outlook to this plea for reconsideration of taxation policy in regard to obsolescence and development. But all three agree on the importance of the obligation of enterprise in industry, and the words of the *Round Table* article might appear equally well in either of the others: "No Board of Directors in these coming years of stress and reconstruction will be acting in consonance with the spirit and needs of the age, or indeed with the interests of its shareholders, unless it puts back into the business a substantial part of the profits to cover research, development and obsolescence. No organized industry can hope to survive in a world market if it falls behind in these matters or is deluded by the Inland Revenue into the belief that advertisement is more than all these things". The same point was well made by Lord Listowel in the House of Lords in urging a steady increase in existing facilities for scientific research into the post-war problems of industry.

That is Sir Harold Hartley's argument, and his review of the present organization of research in Great Britain leads him to make several concrete suggestions. Even the smallest firm should find a place on its staff for at least one man with a scientific training, and should join the research association for its trade. If there is no research association, the trade association should be urged to approach the Department of Scientific and Industrial Research with the view of forming a research association. If the trade has no trade association and no research association, firms which do not employ a research staff are recommended to apply to the Federation of British Industries for advice. If they are in a large way of business they are also advised to consider the establishment, alone or with associated or kindred firms, of a research laboratory. Closer contact between scientific men in industry and those in the universities, and more integration between research and development are also suggested, but Sir Harold does not mention three points which were repeatedly stressed in the House of Lords: adequate remuneration of scientific workers in industry; undue reluctance to pool information on new developments; and the lack of appreciation of scientific methods by the higher Civil Service.

It will be noted that Sir Harold Hartley appears to place his main emphasis on the research association, but it may well be doubted whether, except with the smallest firms, this is anything like the most effective line of advance. On this point Lord McGowan spoke explicitly in the House of Lords debate. While recognizing the value of a research association where no single unit is in a position to create a research installation on a suitable scale, and paying tribute to the work of the Department of Scientific and Industrial Research in fostering and encouraging the research associations, he thought that this system of research, while it may play a large part in future development, has a very long way to go before we can be satisfied that it is up to the standard demanded by modern conditions.

The reasons for this position are readily seen. It can be maintained with considerable force of argument that the true field of work of the research associations lies in the fundamental investigations on the basic problems of the industry—investigations which require planning and co-ordinating frequently in relation to the scientific research which is proceeding at the universities and independent research institutes. There are practical reasons why the research association can never hope to compete effectively with the research department of an individual firm or group of associated firms in the investigation of day-to-day problems and existing processes, in the search for higher efficiency, lower costs and new and improved products. Yet it is exactly on such problems that some research associations tend to concentrate.

This indeed is only what might be expected. An association of firms which individually are not research-minded enough to establish their own research departments, in spite of ample resources, are unlikely to take the long-range view and support the attack by the research association of the fundamental problems on which eventually the prosperity or even the existence of the industry may depend. Lord Cherwell's statement showed that the Government is aware of the importance of fundamental research and prepared to extend its support, but the mere formation of a research association is only the

first step in a programme of education and inculcating research-mindedness. It may well be maintained that the whole experience of the research association movement would endorse the plea for an investigation of taxation methods in relation to research and development for which the *Round Table* and the *Economist* have so boldly called.

We touch here on questions of industrial structure as well as of the organization of research. In reconsidering the structure of industry, this question of research is of cardinal importance in ensuring that spirit and policy of enterprise which are essential both in private industry and in any form of public corporation which may be established to provide safeguards for the public interest. Unless that spirit pervades the management, no change in organization or structure will avert disaster or provide the developments and technical advances on which a policy of full employment and rising standards of living can be firmly based.

Sir Harold Hartley's memorandum may well prove a timely corrective in some of the discussions at present proceeding in these fields, and it is the more encouraging to find that many of his points have been made very forcefully in the House of Lords debate already mentioned. The emphasis which Lord Samuel, Lord McGowan and Lord Dawson of Penn laid on the importance of the highest administrative positions in government service being open to technical and scientific men who had shown themselves fit for such work is indeed relevant. Without support from the top we cannot expect that the resources of research associations or of universities will be adequate for the tasks which now confront them.

What is most welcome in the attention now being concentrated on industrial research is the recognition that this is a matter in which both industry and Government have responsibilities. In addition to the responsibility in regard to the Civil Service and administration just mentioned, the Government must carry a prime responsibility in regard to the adequate endowment of scientific research at the universities. Commenting on Sir Harold Hartley's proposals, Sir Ernest Simon has stated that preliminary investigations of a committee of scientific men and industrialists set up by the University of Manchester to consider what developments are needed to enable the University to render services to industry equivalent to those rendered by leading universities in America, indicate that it will be necessary to think in terms of trebling the Government grant to universities.

Whether or not, as Mr. Bruce Truscot has suggested in his recent book, the universities of Great Britain might make a larger contribution to research from their existing resources, a much larger State endowment is clearly imperative. Lord McGowan has indicated, however, that here also industry has a big part to play. There can now be little doubt that those who insisted that it should be a condition of protection under the Import Duties Act that the industries concerned should pursue an active policy of research and development were fundamentally right. Failure to insist on this, for example, in the iron and steel industry, has clearly been unfortunate, and the record of the Import Duties Advisory Committee is largely one of missed opportunities from which the whole country has suffered.

Lord McGowan made the point effectively in urging this as one reason why industry should play its part in encouraging scientific developments in the universities and technical schools of Britain. He pleaded for industry to play its part by means of financial grants, particularly to ensure that equipment is adequate in quality and in amount.

But this question of closer contact between the industrial and the academic worlds to which Lord McGowan referred touches closely the question of education. Mutual discussion between industry and the academic man of science may be largely profitless if the standard of education in industry is not sufficiently high. The extension of scientific academic facilities and of technical schools is a post-war issue of the utmost importance if Britain is to hold her own and realize the possibilities which greater research-mindedness on the part of industry might put within her reach. Lord Maugham commented trenchantly on the absence of reference to science in the White Paper on Education, and there are few signs that the opportunity which is offered to us by the scientific developments in the Fighting Services and the consequent wider interest in technical science are fully comprehended.

Education, indeed, in its broadest sense, is the key to the situation. The education of the industrialist, for which Sir Harold Hartley pleads, is one line of advance. The education of the Civil servant and the opening of the higher posts in the Civil Service to those trained in scientific research is another, and on this point Lord Cherwell's statement for the Government was hopeful. The extension and improvement of university facilities and of those for technical training at all levels is another, and it is clear from recent statements that have been made that this aspect is being borne in mind. Vital as it may be to effect immediate improvements by all these means, to secure a fuller endowment of research and development work, its adequate co-ordination by administrators imaginatively alive to the issues involved—and that at every stage in industry, from management to the operative—and a personnel technically and scientifically competent, ultimately it is on the educational system of Great Britain that sustained progress depends. To fulfil the manifold requirements, the system must provide the State and industry alike at all levels with recruits equipped to face the tasks of the new age and aware of the scientific and technical factors which enter into its social, industrial, economic and international problems, as well as of the human, moral and cultural values. It is only in this way that industry and State can be directed and staffed by those aware of the vast possibilities of research, competent to plan and to execute an adequate policy of research, and resolute to see that it issues both in greater efficiency in industry and also in the wider and fuller enjoyment by society of the resources which science has put at our command.

SEX EDUCATION AND GUIDANCE

MANY centuries have passed since Alcuin of York wrote that "Since the time of King Aelfwold . . . the land has been absolutely submerged under a flood of fornication, adultery and incest, so that the very semblance of modesty is entirely absent", but variations on the same theme are still played to-day. Since the outbreak of the War, indeed, they have been both numerous and persistent. In part, such dismal wailings may be discounted as the product of present-day tension and upheaval, but after all allowance has been made for this, a nucleus of truth remains. It is a fact that conditions of war almost invariably lead to an increase in sexual promiscuity, and even the least bigoted among us can scarcely fail to be disquieted.

But while it is such war-time behaviour, with its resulting increased incidence of venereal infection, which has at long last been responsible for removing the taboo on public discussion of sex and sexual behaviour, the problem is not in essence a purely war-time one. In the long run, our hopes for the development of a healthy attitude to sex in our society must be based not only on economic and social change, but also on rational and fearless education. The importance of the latter is clearly recognized by the Board of Education, and its recent pamphlet on the subject* will be given a warm welcome by all progressive educationists.

For many years individual education authorities, schools and youth clubs have been undertaking sex education, and some have done excellent work in this field. This is, however, the first occasion upon which the Board has given so clear a lead; and many who were wondering whether or not to go ahead will no doubt do so under this new impetus. It is important that those who do should be very careful, in carrying out this most valuable but rather difficult work, that they adopt methods likely to produce the best results. Not all the efforts in this field in the past have been entirely happy in their conception or fortunate in their results, and thereby the cause of sex education has sadly suffered. It is, therefore, particularly gratifying to note that the Board of Education itself propcses "both to conduct a special course in the near future, which it is hoped may help a number of men and women to assist in local courses, and to deal with this matter where appropriate in other courses that they organise". No doubt advantage will be taken of the experience of those who have for some years specialized in this field, and local education authorities are in fact advised to apply for help to the Central Council for Health Education, which has for some time been providing lecturers, literature, films and general advice.

The pamphlet is in the main based upon the results of inquiries recently made by H.M. Inspectorate, and presents an interesting survey of present practice in this sphere. Apparently, about "a third of the secondary schools in the country make a serious attempt to give instruction", while "the remaining two-thirds of the schools are about equally divided between those who give slight attention to the subject or avoid it altogether". So far as the elementary schools are concerned, "it would appear that in the areas of approximately half the Local Education Authorities in England, and to a lesser extent in Wales, there is carefully planned instruction in at least a few of the schools"; while in other areas, "perhaps one-third of the country . . . practically nothing is done". It is interesting also to observe that "approximately three girls' schools include sex instruction in their syllabus for every one boys' school"—a conclusion that confirms the strong impression to that effect previously held by those who have been concerned in this work.

Excellent in quality as much of this work is, educationists cannot rest content until the great gaps are filled in, and the standard of all such teaching raised to that of the best. The facts gathered by the inspectorate make it very clear that the methods adopted vary widely, and perhaps this is well, for we have as yet insufficient experience to lay down the law about their relative merits. What does seem to be clear, however, is that the instruction should be fitted as inconspicuously as possible into the ordinary school routine, and that sex education is conspicuous in a school only in proportion to its imperfection. In many places, where the staff feels unable or unwilling to incorporate sex education on their day-by-day lessons, recourse is had to the services of the specialist lecturers of the Central Council for Health Education; but this Council itself recognizes that such a method is very far from ideal and can be regarded only as a temporary expedient. This makes it particularly important for local education authorities to arrange courses for their teachers, both to provide the non-biologists among them with the necessary factual knowledge, and to make suggestions about methods of classroom presentation. Apart from courses on biology and health education generally, special courses on sex education have either already been held, or are at present being arranged, for the teachers of Surrey, Middlesex, West Sussex and Dorset among the counties; Dewsbury, Doncaster and Bristol among the county boroughs; and an occasional progressive urban district like Enfield. It is also clear, from the conferences which have been held elsewhere, that many more teachers' courses will materialize before long.

So far as the schools are concerned, the most important task is the presentation of simple but accurate biological information. "But early instruction in the physiology of sex is only the beginning of sex education in the fullest sense. It should be succeeded at the later end of adolescence by instruction and advice directed to the understanding and control of sexual impulse and emotion, leading on to the establishment of mutual understanding and respect between the sexes, and, as young manhood

* Board of Education. Educational Pamphlet No. 119. "Sex Education in Schools and Youth Organizations." (London: H.M. Stationery Office, 1943.) 6d. net.

or womanhood is approached, to an adequate preparation for marriage". The early school-leaving age in Great Britain means that for the great majority of children the schools can do little in this respect, but the youth organizations have a great opportunity. Here the objections to visiting lecturers, which are so potent in the case of schools, scarcely apply, and the usual procedure is for a course of three or four talks illustrated by films to be given by a member of the staff of the Central Council for Health Education. Some idea of the extent of this particular part of the work now going on throughout Great Britain is given by the fact that during the six months of April–September 1943, there have been held 578 such meetings, attended by 16,223 young people.

The Board of Education pamphlet emphasizes that youth leaders "themselves require more accurate and comprehensive knowledge than they already possess". "To meet this need both local education authorities and the youth organisations are increasingly arranging short training courses in sex education for leaders, or are devoting attention to the subject at their general youth service courses." A particularly interesting course was that held recently at Horsham. A carefully selected group of leaders attended a residential week-end school, and at sessions attended by the County Director of Education, Medical Officer and Youth Organizer, a team of speakers dealt with many aspects of sex education in youth organizations. It is likely that as a result of the school, a county panel of recognized lecturers will be drawn up; they should be able to carry out much valuable instruction in the youth organizations of West Sussex.

Particularly in respect of sex education in schools, the fear has sometimes been expressed that there may be parental opposition. Figures collected recently show this fear to be quite unfounded. Some schools and education authorities have, before introducing such lessons, circularized parents of pupils and given them the opportunity of withdrawal. Whether in fact this is a wise procedure is a matter of debate, but the numerical results are quite conclusive. Of 620 pupils from a girls' grammar school in Dorset, only two were withdrawn; of 500 in a similar school in Surrey, four; of 550 in a similar school in Kent, none. A boys' grammar school in Lancashire has given such instruction for some years, with never a single withdrawal; of 470 pupils in a similar school in Surrey, the parents of 380 actually wrote to give approval and to enclose a contribution towards the expenses of the lecturer. The story in senior schools is similar. A Lancashire urban district had twenty-one withdrawals out of 936, and a neighbouring county borough but fifteen out of 2,300. There is indeed a wealth of support for the pamphlet's assertion that "parents welcome any initiative shown by teachers".

Particularly welcome is the Board's recognition, that "the first responsibility rests upon parents to deal with their children's questions from the beginning, as and when they arise, in a natural manner". This, however, raises a serious problem—that of fitting the majority of parents to do so. It is not usually recognized by scientific men that for nine parents out of ten this is at present rendered extremely difficult, even neglecting consideration of emotional unsuitability, by the simple matter of ignorance of the necessary minimum of technical vocabulary.

It is an unfortunate fact that during the last few hundred years the old Anglo-Saxon terms for the sexual organs and the sexual processes have descended far in the social scale, and in many cases have now reached the gutter. Precisely those parents who would be most willing to answer their children's queries will be most reluctant to do so in the only sexual language they know. A warm welcome must therefore be accorded to the pamphlet's suggestion for "The organisation of parents' meetings, with a view to securing their co-operation in anything that is done through the schools, and to helping them in dealing themselves with their own children in this matter". Actual lectures on the physiology and psychology of sex, and on sex guidance to classes of parents, would also seem worth trying. The children's problems are cropping up at all times, and it therefore seems undesirable that in the long run everything should be left to the teacher.

Perhaps the main criticism that can be levelled against this publication is its almost complete scholastic isolation and neglect of the social forces involved as determinants of sexual attitudes and behaviour. The prefatory note refers to "the immediate problem presented by the increased number of young persons who fall victims to the special temptations and circumstances of war-time", and expresses the excellent hope that further efforts will be made "to bring such persons within the influence of the Youth Service". But there is no mystical quality to the phrase 'youth service' which will enable it to conquer its environment. All sorts of social changes will be needed before sex education can yield its fullest fruits. The economic barriers to early marriage must go, and we must so conduct our society that millions of homes are not periodically broken up. Young people must be given some burning sense of social purpose, some feeling that they can be of real service to the community and be valued by it, some belief in a future for which it is worth while to sacrifice immediate sensual gratification. Sex education cannot thrive *in vacuo*. It must be sex education for a particular social setting.

Some educationists may feel a certain disappointment at the benign impartiality of the Board in this pamphlet, and may regret that more detailed and positive suggestions are not given as to teaching technique. But this would be a matter not so much for a pamphlet as for a book, and even a book could do little more than skim over the surface of the many problems involved. There is, moreover, a real danger in the presentation by a Government department of too detailed suggestions, the danger of stifling local initiative and experiment; and if this pamphlet does nothing more than to stimulate such experiment and initiative, the Board of Education will have rendered a great service.

RECENT ADVANCES IN VIRUS RESEARCH

Virus Diseases

By Members of the Rockefeller Institute for Medical Research: Dr. Thomas M. Rivers, Dr. Wendell M. Stanley, Dr. Louis O. Kunkel, Dr. Richard E. Shope, Dr. Frank L. Horsfall, Jr., Dr. Peyton Rous. Pp. ix+170. (Ithaca, N.Y.: Cornell University Press; London: Oxford University Press, 1943.) 12*s.* net.

THE time is not yet ripe for the production of a comprehensive text-book on virus diseases because virus research is proceeding at such a pace that many accounts are outmoded almost by the time they are published. It is unfortunate that the book under review has been given the title it bears for it deals with very few virus diseases, and those from strictly limited viewpoints. It is a collection of six Messenger Lectures delivered at Cornell University by six experts in different branches of virus research. The founder of the series prescribed its title as "The Evolution of Civilization", and the appositeness of the subjects chosen cannot be questioned. Each author naturally lays particular emphasis upon the more recent developments in his own special field. A more appropriate title would have been "Recent Advances in Virus Research".

No individual can hope to keep abreast of all the literature concerning viruses, yet the interrelationship of recent discoveries in human, animal and plant virology makes it imperative for the research worker to have some acquaintance with the whole. This book is admirably adapted to restore that sense of perspective which is so easily lost during the pursuit of knowledge along a single narrow track, partly because of the breadth of the field covered but even more because each lecturer has such a highly individual outlook and method of approach.

The first chapter, by T. M. Rivers, serves as an introduction by first discussing immunity in virus diseases from a general point of view. Rivers corrects the commonly held, but erroneous, idea that virus immunity differs fundamentally from immunity in other infections; special techniques of study have had to be evolved but only because of the peculiar nature of the infecting agents. The nature of viruses is indeed the *leit motif* of the whole book, and Rivers uses the recent advances of knowledge about vaccinia virus to show that, however simple some of these agents may be, the larger ones like vaccinia may have a structural, chemical and antigenic complexity comparable with that of many bacteria. He concludes that infective agents of fundamentally different natures are to be found amongst the viruses.

In the second chapter, W. M. Stanley deals with viruses at the opposite end of the scale of complexity, namely, those plant viruses which can be obtained, pure, in crystalline form. He is especially concerned with alterations of chemical structure as a key to virus mutation. The idea of mutation being dependent upon modification of chemical structure is no new one, but the crystalline plant viruses have, for the first time, opened up the possibility of direct experimental attack on the problem. The examination of eight strains of tobacco mosaic virus for only five amino-acids and sulphur revealed significant differences, and it is obvious that this line of attack promises fruitful results. It is a long cry yet to the purposive creation of virus variants for prophylaxis by chemical manipulation, but the author envisages the possibility and describes his own attempts to this end by which he has reduced the virulence of a virus for one host species while leaving its virulence for another unchanged.

Chapter 3, by L. O. Kunkel, is devoted to the importance of finding new hosts in virus research, and the thesis is supported by a wealth of illustrations drawn from recent research. Chapters on swine influenza by R. E. Shope and human influenza by F. L. Horsfall give fairly comprehensive accounts of these diseases and are to some extent mutually complementary. Unlike the swine disease, human influenza is not a clinical entity; the term embraces a number of conditions, and Horsfall follows the usual classification into pandemic, epidemic and endemic forms. Research has, perforce, been mainly concerned with the epidemic form because the etiological agents of the other two are still unknown, and the facts thus far garnered have raised as many problems as they have solved. Human influenza was the subject of a recent monograph by Burnet and Clark, and, while Horsfall covers much of the same ground and gives an admirable summary and critical appraisement of the present position, the limitations imposed by a lecture have prevented such exhaustive treatment as was given by the Australian authors. Shope is fortunate in having a much more circumscribed field to survey. He gives a detailed account of his own researches, which have gone far towards the solution of the epidemiological puzzles presented by the swine disease, namely, the whereabouts of the virus between epizootics, the reason for seasonal incidence, and the means whereby wide dissemination occurs in a very short time. His discovery of helminth intermediate hosts of the virus has led him to a new, unorthodox conception of swine influenza epidemiology, which excludes direct transmission as a major factor and postulates the seeding of a herd without any chronological relationship to the onset of an outbreak. The epidemiological patterns of swine influenza and some forms of the human disease are so similar that Shope's work is bound to provide a stimulus for further research on the latter along unorthodox lines.

In the last lecture Peyton Rous gives a masterly exposition of the relation of viruses to tumours. The list of tumours in which a virus has been proved to be the actuating cause is not a large one and does not include any mammalian malignant growth, but there is no tumour for which any other actuating cause has yet been discovered. The author emphasizes that the chemical and physical carcinogenic agents are in an entirely different category—he terms them provocative carcinogens—for, once they have provoked malignant potentiality into activity their role is ended, they do not increase in quantity as the growth enlarges and they have no effect in determining the kind of tumour which arises. There is much indirect evidence that viruses may exist and multiply within the cells of a tumour from which no virus can be isolated. Especially significant are the cancers which often arise within the benign rabbit papilloma, which is known to be caused by a virus; virus mutation is suggested as the likeliest explanation, and a re-reading of Stanley's lecture with the tumour discussion fresh in mind cannot fail to prove stimulating.

He would be a dull virus researcher who could read this book without feeling an urge to get back to his laboratory.

WILSON SMITH.

METEOROLOGY AS A CULTURAL SUBJECT

Ways of the Weather

A Cultural Survey of Meteorology. By Dr. W. J. Humphreys. Pp. v+400. (Lancaster, Pa.: The Jaques Cattell Press, 1942.) 4 dollars.

DR. W. J. HUMPHREYS is well known among meteorologists the world over as the author of a number of valuable books on meteorology. In his latest book Dr. Humphreys aims at providing "an easy stairway, or even a gentle ramp for some, in this corner of the temple of knowledge". Here and there he discusses aspects of the weather which find little or no mention in the ordinary text-book, while the sixteen chapters of this book will give the reader a sound basis for building a fuller structure of detailed knowledge.

The aim of the book is to treat meteorology as a cultural subject, which presents a myriad facets of interest to the intelligent man, entirely apart from any application to the business of life, though these applications are indicated in the course of the book. Technical expressions are almost entirely avoided, even when they might have facilitated the discussion of the point at issue.

Methods of observation are described in an early chapter, and subsequent chapters deal with the distribution over the earth and at different heights in the atmosphere of temperature, water vapour, pressure and wind, the travel of sound through the air, meteorological optics, electrical phenomena and thunderstorms. The function of the sun as the source of all atmospheric energy is brought out clearly. One of the best parts of the whole book is that which deals with the formation and classification of clouds; this is illustrated by an extremely well-selected and beautifully reproduced series of cloud photographs.

The author draws no distinction between cloud droplets and rain-drops except that of size. It would have been worth while at this stage to give some indication of Findeisen's theory, according to which the distance through which a drop of water can fall through the air before it is completely evaporated is proportional to the fourth power of its initial radius. Thus, if the relative humidity of the air beneath a cloud is 90 per cent, a cloud droplet of initial radius 10 μ will only fall through a vertical distance of about 2 in. before being completely evaporated; a cloud droplet of initial radius 100 μ will fall through a distance of about 500 ft. before complete evaporation occurs; any droplet having a radius appreciably greater than 100 μ will fall to the ground as rain. This fixes 100 μ as a rational and useful limit between cloud and rain. The reader would also have been interested in Bergeron's theory that the formation of rain-drops large enough to fall to the ground is due to the fall of ice crystals through clouds of liquid droplets. The medium in which the water drops are suspended must be supersaturated relative to ice, so that rapid condensation takes place on the ice crystals, with consequent drying out of the medium and evaporation of the water drops. The ice crystals grow and fall to the ground, being melted into rain-drops on the way down.

I have few faults to find with Dr. Humphreys' book. It has achieved its aim to a remarkable degree, and while avoiding difficult concepts has contrived to give the reader a clear picture of many of the phenomena of weather. The author has a scholarly mind, and a pleasing way of quoting passages from the Bible or from the Latin and Greek classical authors when, and only when, they illustrate the point under discussion. Thus on p. 227, in the course of a discussion of St. Elmo's fire, we find the following passage from Cæsar's Commentaries: "In the month of February, about the second watch of the night, there suddenly arose a thick cloud, followed by a shower of hail; and the same night the points of the spears belonging to the Fifth Legion seemed to take fire". After a careful perusal of this book, the reader will have acquired some idea of what makes the wind blow, why the trade winds blow from the east, why it is generally colder on a hilltop than in the valley, why a rainbow is never seen at noon on the equator, why 'Aurora's fingers' are rosy; and if he has sorted out the appropriate factors, he will also have learned how to select the ideal site for a home, either for himself or for his apple trees.

One question recurs to me, as it always does after reading any book which aims at presenting a complex subject in simple terms: Will the reader of this book of nearly 400 large octavo pages really be as non-technical as the author assumes? Is that reader in fact helped by the statement made on p. 128, concerning the molecules in air, that "if 500,000 people were each picking them out at the rate of 100 per minute, day and night, it would take them 1,000 years to accumulate enough to make a volume of the air we breathe as large as the head of a pin". Would it not be better to give the number of molecules in, say, a cubic centimetre or in a cubic inch, possibly supplementing it by the statement that it is a 'whale' of a large number?

D. BRUNT.

MOUSE GENETICS

The Genetics of the Mouse

By Dr. Hans Grüneberg. Pp. xii+412+14 plates. (Cambridge: At the University Press, 1943.) 30s. net.

THE study of inheritance must always be more laborious than most other forms of biological investigation which concern themselves with only one phase of an animal's whole life-history. It is therefore not surprising that there are only very few animals, and not many more plants, about the genetics of which we know enough to feel confident of having even a crude picture of their commoner modes of variation. Among these animals the mouse holds a very important place. The rapidity of its breeding, the comparative ease of maintaining colonies, and the large number of variations bred by 'the fancy', have made it perhaps the favourite mammal for geneticists. It shares, with Drosophila and maize, the distinction of having a 'hot news' journal (*Mouse Genetic News*) devoted to the technicalities of its genetics and circulated semi-privately to scientific murophils. A new monograph summarizing the enormous literature which supports the mouse's standing in the world of geneticists will therefore be welcomed, both by specialists, who will find it a convenient summary of their field, and by non-murine geneticists, who want a guide through the tangles of the subject. Both these groups will find Dr. Grüneberg's treatise, with its classified list of 1,141 references, entirely satisfactory for their needs.

"The Genetics of the Mouse" is, however, something more than a merely competent summary of available data. The particular richness of mouse genetics, at its present state of development, lies in its wealth of

examples of morphological abnormalities occurring during the development of a mammal, and in this field Dr. Grüneberg is one of the foremost investigators in the world. His account of these aspects of the subject is the fruit of a long and intimate acquaintance with the material, and embodies many original, and to some extent not previously published, observations. It is certain to remain for many years the standard work on the subject.

Grüneberg very justly emphasizes the great interest that many of these developmental abnormalities may have as experimental material for physiological and pathological investigations, in which the purely hereditary side of their behaviour would be of minor importance. His book is, in fact, a storehouse in which biologists of many kinds could find fruitful suggestions for studies in their own fields. The famous example of the pituitary dwarf is an instance which has, of course, already been put to good use by hormone specialists. Similarly, the rodless retina race has been employed in some studies of behaviour, and so have the famous 'waltzer' and 'shaker' strains, though more remains to be done with the numerous pathological variations which are available. There are numerous other types, such as the two forms of hydrocephalus, or the race with a hereditary absence of the corpus callosum, about which we know much less. The extraordinary pathological conditions of the integument in races such as 'naked' and 'rhino', and the lesser abnormalities of hair-growth in the various 'waveds', 'caracul', 'rex', etc., offer another wide field for future investigations; and so do some of the sexual conditions, such as the association of deficient mammary development with hairlessness, the 'imperforate vagina' condition and others. The use of genetical methods in the study of susceptibility to cancer and tumour transplantation in the mouse is, of course, a classical example of such a broadening of the purely genetical outlook. It is the subject of a special section of the book, contributed by two specialists in the field, Drs. Little and Gorer. Unfortunately this is in some ways not so satisfactory as the greater part of the work, perhaps because there is scarcely space to make clear the somewhat complicated situation, or, perhaps, because of war-time difficulties in communication between joint authors on different sides of the Atlantic.

Of all the numerous aspects of biology touched on in the book, that which is closest to the personal interests of the reviewer is the embryological. It would scarcely be possible to better Grüneberg's account of the facts of the development of the various abnormalities; and he can unravel some of the causal sequences involved, such as the consequences of the failure of secondary bone absorption in grey lethals. But on the whole it must be admitted that the genetic abnormalities in the mouse pose many more developmental questions than they answer. Even in so well-investigated a case as the grey lethal, we have no inkling of the relation between the skeletal and the pigmentary effects. Grüneberg, perhaps wisely, makes only a very sketchy attempt to classify the types of developmental abnormality which are encountered. In by far the majority of cases, our knowledge ceases when we have traced the pathological condition back to some developmental process which takes place in a sub-standard way for reasons unknown. In contrast to Drosophila (or plants) there are few cases where one organ is replaced by some other organ properly belonging to another region of the body; there is nothing at all closely corresponding to conditions such as aristopedia, bithorax, tetrapter and the rest. Speaking metaphorically, the members of the mouse orchestra do not tend to come in at the wrong time with the right phrase—their fault is a tendency to play out of tune. Is this difference connected with a lower degree of functional metameric symmetry in a mammal than in an insect? Or with a greater elaboration of the evocators or 'switches', which makes it less easy for the wrong key to open the right door? No answer can yet be given; that is another, and one of the (to me) most fascinating of the stimulating questions raised by Grüneberg's book.

C. H. WADDINGTON.

KEEPING UP WITH ORGANIC CHEMISTRY

Dictionary of Organic Compounds

The Constitution and Physical and Chemical Properties of the Principal Carbon Compounds and their Derivatives, together with the Relevant Literature References. In 3 vols. Vol. 1: Abietic Acid—Dypnone. New, revised and enlarged edition. Edited by Prof. I. M. Heilbron and H. M. Bunbury. Pp. xvi+1072. (London: Eyre and Spottiswoode (Publishers), Ltd., 1943.) £6 6s. net; complete, £15 15s. net.

THE original edition of this first dictionary of the kind in the English language was finished at the end of 1937, and it was then hoped to issue revised volumes at regular intervals, beginning in 1939 (NATURE, Nov. 17, 1934; Feb. 29, 1936; Feb. 19, 1938). The outbreak of war interfered with these plans, and in the circumstances it is a remarkable achievement to have produced this new edition of volume 1. The plan of the work remains unaltered, and the format is identical with that of the first edition, except that a thinner paper and narrower margins have been used. As a consequence, the new edition of volume 1, comprising 1,088 pages, is lighter and more compact than the old one of 726 pages.

The volume has been completely rewritten. The many new entries cover the literature of organic chemistry to the end of 1940, and there are some references to still newer work published in 1941 and 1942; at the same time, certain omissions from the first edition have been remedied. As an illustration of the considerable increase in the number of entries, the section from "Carene" to "Carvoxime" has grown from 3½ to 7 pages. In a work of this kind it is particularly difficult to maintain a high standard of accuracy, yet this has been done. It is, indeed, something of a feat for a critic to find a formula for α-cyperone lacking a methyl group, or to discern a certain dubiety in the bracketing of carvomenthenol with piperitol.

It has not proved practicable under war conditions to rewrite volumes 2 and 3. These, of course, are not so far behind the times as the original vol. 1. As they have been out of print for some time, they are being reprinted with supplementary data collected since the original publication. Moreover, vol. 1 contains cross-references to compounds included in the supplements to volumes 2 and 3. Prof. Heilbron, Mr. Bunbury, and their collaborators have once more earned the gratitude of the chemical community through their labours in maintaining and improving this invaluable Baedeker of organic chemistry.

JOHN READ.

THE FUTURE OF ANTHROPOLOGY

A CENTENARY meeting of the Royal Anthropological Institute was held on October 30. The first part of the proceedings, at the Royal Society, consisted of addresses on the work of the Institute by Sir John Myres (see NATURE of October 30, p. 493) and on "The Role of Anthropology in Colonial Development" by Lord Hailey. This was followed by a symposium on the future of anthropology, held at the Institute, with the president, Prof. J. H. Hutton, in the chair. Four short papers on different branches of the subject were read, each being followed by a discussion.

It was said that the problems of anthropology are more diversified than those of any other science. Thirty years ago, teachers—notably C. G. Seligman and A. C. Haddon—were still able to survey the whole field, but no one attempts to do that to-day in any comprehensive way. Accessions to knowledge and developments in method have entailed increasing specialization, and it is now inevitable that different branches of anthropology should be surveyed by different workers. The meeting gave an opportunity of judging how far they have drifted apart, and of assessing the advantages and disadvantages of that process.

The first of the four papers was read by Dr. G. M. Morant, his topic being the future of physical anthropology. Three main branches of the study were distinguished:

(1) Man's place in Nature. It may be doubted whether the further study of living forms—by zoologists, anatomists, embryologists or physiologists—will ever throw much clearer light on man's origin, and advances in genetics are not likely to reveal the course of his descent in any detail. More precise knowledge regarding these questions must depend primarily on future discoveries of fossils representing the earliest human and related non-human forms.

(2) The evolution of man judged from his skeletal remains of geological antiquity. Here, again, progress must depend on new discoveries, these being of far more importance than further speculation regarding specimens already described.

(3) The relationships of populations that have existed since palæolithic times. Methods of interpreting the records of series of living people and skeletons have been transformed in the present century owing to the development of statistical methods and genetics. These necessitate fundamental changes in the classical concept of race in man. It was suggested that two ideas which will have to be abandoned completely are: (*a*) that a race is a group of people separated from all others on account of distinctive ancestry; and (*b*) that analysis of modern populations in terms of 'pure races' presumed to have existed at some earlier time is possible.

Dr. Morant referred next to the provision made for teaching and research in British universities. Before the War, there were in Great Britain three whole-time posts for physical anthropologists—a readership at Oxford, a lectureship at Cambridge, and a lectureship at University College, London—but no one of these is actively occupied at present. For several years courses in the subject have been given elsewhere by teachers appointed primarily for other purposes.

Finally, practical applications of the study were discussed. These are concerned principally with: the interpretation of medical and demographic statistics; the provision of equipment for the personnel of Fighting and other Services; the exposure of unscientific racial dogmas.

In his paper on the future of archæology, Prof. Gordon Childe dealt with general aspects of the subject rather than specific tasks which will confront archæologists after the War. Existing human institutions, he said, can only be comprehended in the light of the past, and archæology presents the abstract, and therefore potentially scientific, aspect of human history. The Institute has contributed largely to converting the study into a science in the British Isles.

A workable basis of classification has been established, its three aspects being functional, chronological and cultural. Thanks largely to collaboration with technologists, the functions of nearly all artefacts are now understood. The problems of chronology have also been reduced to order and the framework of a scheme has been set up. New techniques that have emerged in the past two decades—concerned with tree-rings, varved clays and pebble counts—open vistas which must be more fully explored.

The cultural classification is a more recent development. The earlier concept of an evolutionary and linear sequence, which found expression in de Mortillet's system of prehistoric phases and Morgan's stages of social organization, is now abandoned. Culture is now recognized to be adaptation of distinct societies to differing environmental conditions. The change of outlook necessitates re-examination and reclassification of the vast accumulation of prehistoric implements preserved in collections.

The work of classification is so far advanced that sober interpretation may be attempted in the form of generalizing hypotheses which unify a mass of data. Much explanation in prehistory has been undisciplined, such as that which postulated the scarcely credible voyages and migrations of peoples of whom we really know nothing. Theories of diffusion are mythopœic unless they can be substantiated by concrete evidence, such as that provided by skeletal remains or intrusive artefacts.

Archæology is more scientific when it asks not where a society came from but how it attained its peculiar development. New possibilities in this direction have been indicated by the studies of Soviet workers. They involve the total products and refuse of a society which are sampled in the total excavation of domestic sites. The sites should be carefully chosen for the verification of well-considered hypotheses. The methods in question might be extended profitably to cover historical periods. It is absurd that we know more of the domestic architecture of neolithic Thessaly than of Periclean Athens. The approach referred to is not altogether new in prehistory, as it was expounded by Pitt Rivers. Application of the methods to give comparative studies of societies or regions over centuries would go far towards providing a solution of the problem of the nature of progress in material culture.

In his paper on the future study of material culture, Mr. R. U. Sayce discussed principally the developments in museum collections which are most needed. He urged that regional museums, specializing in local cultures, should be encouraged. Some of this kind are already well established in the British Isles and elsewhere. Others should be instituted, such as a museum in Nigeria to illustrate the numerous cultures of West Africa, one in the Sudan and at

least one in East Africa. The regional collection should be of vital interest to the people of the country. It helps them to appreciate their past and to gain a wider knowledge of their present condition. It may also foster the development of native cultures. Mr. Sayce stressed the need—so often voiced by anthropologists—for immediate action regarding such matters, since the material is rapidly disappearing.

There should also be more museums having a wider scope at suitable centres in Great Britain, especially in university towns. Useful comparisons may be made between our own craftsmanship and that of peoples in remote parts of the world. Russian museums must have helped to break down psychological barriers between the 'civilized' and 'primitive', and to encourage mutual respect between European and non-European peoples.

We have neglected the study of native arts and crafts. Much remains to be learned regarding the selection and quality of raw materials, the emotional attitudes of the craftsmen, and the efficiency of the implements they use. There is a pressing need, too, for distributional studies. Much work on these lines has been done in America and Africa: in Great Britain we have failed to keep abreast of progress on the Continent. There are few of our own things for which the distribution is accurately known. Field-work at home might deal with such questions as the boundaries of distributions, diffusion in progress, methods by which cultural objects are spread, and factors which hinder their dispersion. Experience gained in examining such problems here would be an invaluable preparation for ethnological work abroad.

The last of the four papers, by Dr. Raymond Firth, dealt with the future of social anthropology. He defined this branch of the subject as the scientific study of human culture. It analyses the nature and meaning of men's rules, conduct and beliefs in different types of society. As world relationships have developed, the scope and methods of the study have tended to change. Anthropologists used to be interested mainly in primitive peoples considered in isolation. With the world-wide extension of trade, political interests and missionary and philanthropic effort during the last century, primitive tribes have lost much of their isolation and many of their ancient customs. The interest of the social anthropologist has therefore shifted towards the study of culture-change, especially the effects of civilization on the comparatively undeveloped tribal societies.

The future will see a still greater interest in social processes and their aims: in how societies change and can be made to change; in what kinds of economic, political and religious organization are most desirable, and how they can best be achieved. After the War, changing conditions will present anthropology with new and more complex problems to study. The peasant societies of Europe and the Far East, as well as those of Africa and the Pacific, will need investigation by experts. At the same time there will be a call for more systematic study of many institutions and beliefs in Western culture. On the practical side, social anthropology may be expected to play a special part in applying its results to colonial problems, though without necessarily subscribing to the colonial idea.

Such future trends will involve more collaboration with other social sciences, and more systematic development of social anthropology itself. More international cross-fertilization of ideas and methods is needed. Planned social surveys can be envisaged, with, say, Chinese, Africans, Americans and Europeans working as a team, or as a body of advisers, dealing with a problem or an area anywhere in the world. Schemes may often be concerned with a particular problem encountered in a number of societies rather than the intensive study of a single society. This will mean a more active exchange of research workers between countries; more training facilities and more research centres, especially in areas outside Europe and America. It should also mean helping the public, by talks and books in non-technical language, to appreciate the significance of the work of the anthropologist. In time, social anthropology will be recognized as a necessary aid to the understanding and rational control of man's social life.

The discussions which followed the papers were discursive, as such discussions usually are, but a vital issue was raised by Prof. Daryll Forde. He emphasized the need for consideration of the relationships between different branches of anthropology, and pointed out that their integration should be the concern of the Institute as a whole. Dr. Firth's comments on this topic must have surprised some of his colleagues, since he implied that such integration is neither logical nor desirable. For him physical anthropology is a branch of biology, archæology is subsidiary to history, and social anthropology is further removed from either than it is from sociology. There is no reason, he said, why social anthropology should be considered to have closer ties to physical anthropology than to medicine. These were provocative remarks.

Owing chiefly to the limited time at their disposal, perhaps, no one of the four readers of the papers had dealt specifically with the relationships between different branches of anthropology, though they referred to this question incidentally. For Dr. Morant, the purpose of physical anthropology is to reveal the biological history of mankind, from its source to its latest manifestation in the racial populations existing to-day. In his discussion of the light that the archæologist may throw on the development of human institutions, Prof. Childe pointed out that there should be collaboration with the physical anthropologist. Their studies have many points of contact, and they meet on common ground in considering the problem of race and culture. It was also observed that there are intimate relations between archæology and the study of the material culture of historical times. Mr. Sayce dealt principally with modern artefacts, but he pointed out that interpretation of their development and present distribution necessitates study of earlier material. With regard to this point, the attitude of the physical anthropologist and of the student of material culture is the same. If the one is largely concerned with the bodies of living people and the other with the things they make, the present is considered by both as the outcome of the past, so that all their problems are viewed in historical perspective. These three branches of anthropology deal with different kinds of subject matter, but the connexions between them are clear.

Group activities of human beings not falling within the scope of the archæologist, and other than those expressed by material articles, have still to be taken into account. Dr. Firth defined social anthropology as the scientific study of human culture in different types of society. 'Culture' here was taken to cover 'rules, conduct and beliefs', but not articles

produced. The discussion was confined to social processes in existing communities, and nothing whatever was said about any historical considerations. It may be assumed that in dealing with 'culture-change', which was his main theme, Dr. Firth would not consider that the historical evidence of contact between European and non-European peoples in the past few centuries is entirely irrelevant, but he certainly implied that the evidence of earlier 'culture-changes', including all in the archæological sphere, might be disregarded by the student of the modern problem.

If social anthropology is restricted in this way, then there is obviously a gap in the system. Who is to study the world-wide history and development of social institutions? British anthropologists of earlier generations supposed that this is the major task of the social anthropologist, so that he would make contact with the archæologist on one side, and on the other he would interpret existing forms in terms of evidence of a historical kind. Generalizations regarding these matters which were widely accepted at one time have since been discredited. It may be supposed that a revolt against 'evolutionary' theories of social development was one of the factors which made many social anthropologists concentrate on the study of existing societies; and it may be suggested that neglect of historical evidence makes them less anthropologists and more students of comparative sociology. This would have been the conclusion of their predecessors.

Another, and more decisive, factor which may be presumed to have disposed social anthropologists of the modern school to neglect historical evidence has been the desire to make their researches applicable immediately to practical affairs. In recent years appreciation of the value of applications of knowledge gained by students of the life of 'primitive' peoples has been increasing. In his address to the anthropologists at their centenary meeting, Lord Hailey said that those concerned with Colonial affairs feel that study of the way in which social groups originated has little relevance to administrative problems. But they have far more interest in the recently developed anthropological school which concerns itself not with the origins but with the way in which the groups function. Lord Hailey advocated the encouragement of this school in our universities in the interests of the Colonial Service. But if their numbers and resources are not augmented, there is a danger that all the energy of the academic workers in question might be absorbed in dealing with the practical need. It may be suggested, in the interests of science, that if the Colonial or any other Government Service expects to receive such assistance, then it should be prepared to pay for it, either by subsidizing universities for the purpose, or else by founding a State-controlled institute. If this is not done, the gain to the State will be a cultural loss to the country.

The same issue between pure and applied anthropology has affected the physical branch of the subject. Some students of it—particularly in the United States—have devoted themselves to problems having an immediate bearing on practical questions. In so far as such researches are not intended to throw light on any historical topic, it may be questioned whether they can rightly be called anthropological. Alternatively, they may be supposed to come within the scope of human or social biology, or human genetics, or eugenics. In Sweden the issue has been resolved in a satisfactory way: "The Swedish State Institute for Race Biology"—to which title "Human Genetics" was added later—was established in 1921. Its first major activity was an anthropometric survey of 47,000 conscripts. The satisfaction of the anthropologist in seeing a type of research which he initiated carried out in such a way must be entirely unqualified.

At the meeting with which this article deals, Prof. Forde remarked that a centenary celebration may be considered as a ritual death and rebirth. It is a time for taking stock of the past and preparing plans for the future. It may be suggested that there are two matters which the Royal Anthropological Institute might well consider at the present juncture. The first concerns the definition of the science of anthropology as a whole, and of the branches into which it can be most conveniently divided in this age of specialization. The relations between these branches might be considered at the same time. The second matter concerns the applications of the science to practical affairs, and the general policy of the academic workers concerned regarding the allocation of their resources to further practical needs, on one hand, and the progress of their 'pure' science, on the other.

GEOGRAPHY AND INTERNATIONAL SETTLEMENT

By W. FITZGERALD
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INTEREST in the contribution of geography to knowledge has been greatly stimulated through the influence of war. It is realized that the organization of the war effort in Great Britain depends on a very careful estimate of the resources of all the belligerent powers. Moreover, in preparation for peace, the planning of community life in its proper relation to environment is now accepted as worthy of serious study. At the next peace conference statesmen will undertake a vast experiment in political geography. The framework of frontiers which they then erect will prove its worth in so far as it meets local needs within the boundary zones and at the same time promotes equilibrium in international relations.

In the application of political geography to the study of international affairs the following arguments, briefly outlined, emerge:

(1) Geography establishes a close relationship between types of human organization and their environments; and the particular objective of political geography is an investigation of the extent to which the nature of States, together with their organization and interrelations, is influenced by, and adjusted to, conditions of geography.

(2) The political pattern of the world is subject to ceaseless modification, and for two main reasons: (*a*) The factors of physical environment on which the pattern largely depends are themselves subject to processes of change which are beyond man's control. Thus, to take an illustration from the Middle East of the Old World, desiccation of climate in past times had the effect of destroying the prosperity of States, and, indeed, of denuding whole regions of all organized life. (*b*) In the political, as also in the social and economic, evolution of mankind—the adjustment of life in all its varied manifestations—to environ-

ment is itself in process of continuous change. This adjustment is, in part, a conscious selection by man of opportunities offered by Nature. It is not solely a matter of geographical influence, much less of geography acting as an agent of determinism. Man assists in designing his own environment, and does so in the light of experience and of his estimate of the opportunities which the physical environment has to offer. Thus the stage of civilization reached is a factor of primary importance in shaping the character of the adjustment. Moreover, the communities of mankind greatly vary in their methods of response to environment, although care is taken not to attempt a comparison between peoples in respect of their innate capacities. Such an investigation is certainly not for the geographer.

(3) The interrelations of States become ever closer—though not necessarily more sympathetic—as man surmounts the geographical difficulties of distance, climate and terrain. Political isolation is impossible to-day, as all States have been brought to realize.

At times of political re-settlement, such as the period now approaching, the geographical basis of frontiers and their justification receive unusually thorough investigation. It is then realized that the boundaries which divide the sovereign States of Europe are instruments of regional partition which have no sanction in geography. Frontiers in geography are rare, and almost everywhere there is transition from one set of environmental conditions of climate, land-form and vegetation—summarized by Herbertson in the term 'natural region'—to another of contrasted characteristics. Moreover, transition is not confined to the physical environment of man. As all his organized activities—in settlement, economic production, State-building, etc. —are influenced by physical geography, the characteristics of one type of civilization associated with a particular region merge with those of a neighbour-type. Such mergence is at times in defiance of political frontiers which, over long periods, are unable to prevent—though they tend to hinder—the spread of cultural influences from one country to another.

As no sanction for frontiers is found in geography, the term 'natural frontier' cannot claim geographical validity. It is most commonly employed in a military context, and to the soldier signifies a boundary which, of those available, is the most likely to provide an adequate line of defence. Until the advent of air warfare the crest of a mountain-range was considered to be the ideal 'natural frontier'; but configuration is not the only environmental feature which might be the basis of natural divisions. Equally natural would be a line defining the limits of nationality. Similarly, the limit of a coal-field or some other industrial zone is entitled to be termed 'natural'. Obviously, any such line is selected for, and justified by, the particular end which the boundary commissioners have in view, but that is not to say that it is endorsed by geography.

As the world is a whole made up of interrelated parts, political frontiers, however 'natural', are artificial lines of division which obstruct inter-regional co-operation, their purpose being to partition what to Nature is indivisible. Through their influence adjacent peoples are turned away from association with each other, and are led to exaggerate the usually small ethnological and cultural differences which distinguish them. Moreover, as they correspond more with political ideals than with geographical realities they may be opposed to a satisfactory economic and social adjustment of the community to its environment.

In a Europe of rival sovereignties devotion to frontiers arises mainly through lack of confidence in any safeguard of social and political security other than military defence; and the defence of frontiers is intended to be a guarantee both of the inviolability of individual States and of the stability of the political balance as a whole. There is, however, no possibility of dividing from each other the peoples of the great middle zone of Europe by frontiers which exactly define their limits. The widespread intermingling of populations of various ethnic and cultural origins, which is characteristic of European society, had already occurred before the partition of Europe into nation-States fixed the population of the Continent by restricting inter-regional migration. Further, there is no geographical correspondence between the distribution of nationalities and the distribution of the regions within which population is concentrated. The welfare of the Continent depends on an economic integration of its regions, similar to the economic integration which the United States have attained; but at the same time the autonomy of Europe's many nationally-conscious communities must be preserved. Only on such a basis does European equilibrium seem possible.

If ever the European system of sovereign States should be replaced by the United States of Europe, the nations would relinquish much of their individual claim to sovereignty, while retaining cultural and administrative autonomy. Boundaries would still be required for the purposes of administration, as they are required, for example, in the federations of the Dominion of Canada and the Union of South Africa. Once the idea of national sovereignty is removed from the concept of frontiers, they cease to be the main source of international dispute, and changes affecting them become matters of comparatively simple local adjustment. The principles on which boundary demarcation would then be effected would have more to do with the economic and social welfare of mankind than with the claims of nationalism.

The need of the world is less a partition of territories between the Powers according to this or that formula than an ordered redistribution of population within the habitable regions of the world. The present congestion of certain lands and the emptiness of others does not correspond to the distribution of the world's potential resources. There are vast areas within the temperate and tropical zones the climate, soil and vegetation of which are favourable to human life, but which still lie fallow. Their frontiers are closed to settlement for a variety of reasons, among them the desire for racial exclusiveness and the intention to protect certain economic standards against the intrusion of peoples of low material level. On the other hand, there are large areas of the Old World where densities exceed a thousand persons to the square mile, and where standards of life are greatly depressed by extreme pressure on the available land. Such pressure is, in many instances, increasing because of a prolific birth-rate. In countries where congestion is very acute, not only internal administration but foreign policy also is affected, and the harmony of international society is endangered. Unilateral efforts on the part of individual States to ease the situation within their own borders

cannot be more than partially effective, and the normal outflow of emigrants in search of new homes is prevented by frontier restrictions, which had become increasingly prohibitive before the War. The settlement of the empty, or half-empty, but habitable lands and a corresponding reduction of density in the congested areas, constitute the supreme task of planning now confronting the world. It is a problem to which the geographers should pay continuous attention.

The demands for 'living-space' raised aggressively by Germany are not derived from an objective study of society and environment. Compared with a number of other countries—some of which she has claimed the right to annex—Germany is not overcrowded. Moreover, it could be shown that the natural endowment of German soil is not inferior to the average for Europe as a whole, and that applied science is capable of raising the productiveness of the more sparsely populated districts of Germany to enable them to support much higher densities without overcrowding.

An unscientific attitude towards 'race', with absurd claims of 'Aryan' superiority and intolerance of their neighbours, combine to explain the German demands for *Lebensraum*. Given the type of mental discipline inculcated by the Nazi creed, such demands are inevitably justified by a philosophy of determinism, which is the sanction of Germany's bid for world hegemony. So is explained the emergence of the pseudo-science of *Geopolitik*, which is little more than the prostitution of the ideas of political geography to the ends of a selfish nation.

It is not on the strictly scientific side of geography—concerned with the accurate location and relationships of phenomena in terrestrial space—that German education requires fundamental revision. Their cartographical, geomorphological and climatological disciplines have nothing to learn from us, and in such respects, it must be admitted, their contribution is not excelled by any other nation. But the Germans have long been under the influence of a mystical conception of the destiny of the Teutonic peoples and of the intention of Providence to grant them a dominating position in Euro-Asia. Their geographical perspective may be unsound; but its error is slight compared with the distortions to which history and anthropology are victims in the hands of Nazi scholarship.

In Great Britain there is little possibility of geographical investigation being tainted with the excessive determinism of the politico-geographical school of Haushofer and his associates. The contacts of British geographers with the Continental philosophers of the subject have shown more appreciation of the enlightened doctrine of Vidal de la Blache—with its insistence on man's freedom of initiative—than of any other. The influence of the German school has been relatively slight; indeed, it is doubtful if the best geographical work in Germany from the time of Ritter and von Humboldt onwards has been adequately studied in Great Britain. So strong has been the refutation by British scholarship of conceptions of economic and geographic determinism, since they were introduced from the Continent by the historian Buckle and others, that the most distinguished of our geographers cannot be charged with proposing any causal relationship between environment and man's aspirations. (This deserves to be known so as to correct an impression which may have been left by a contribution to NATURE, **147**, 546; 1941.) There is now the possibility that, in constant danger of the charge of materialism as they are, geographers may omit to state with sufficient confidence their conception of the scope and aims of their subject.

SPATIAL ISOLATION OF SEED CROPS

By GORDON HASKELL

THE sudden increase in the acreage of seed crops in Great Britain has brought with it a number of problems. One of the major problems confronting the seed grower is that of reducing to a minimum the amount of contamination of one crop by pollen from an adjacent one.

There are two methods of tackling this. Zoning is now in force for Chenopods, namely, sugar beet, garden beet and mangels, and is shortly to come into force for Brassicas in the Essex seed-growing areas. The second and more usual way of reducing cross-pollination is by spatial isolation, that is, by isolating the crops at certain guaranteed distances from each other. The following account is a survey of recent investigations to determine the safe isolation distances for the vegetable seed crops of Great Britain[1].

Bees are the chief agents of dispersing pollen of *Brassica oleracea* plants, and wind also carries the pollen of kale and kohl-rabi. This necessitates keeping crops of any two members of the same Brassica group[2] at a considerable distance apart. A spatial isolation of two miles is common, and sometimes only one mile for cabbages and kale. Recent experiments at the John Innes Horticultural Institution[3] indicate that under natural conditions no crossing, or perhaps slight, occurs beyond 80 ft. intervals between radish plots. The usual isolation is not less than 40 rods. Tedin[4], working in Sweden, investigated the danger of crossing in turnip seed production. At 27 yd. between crops he obtained a 1 per cent contamination, and there was no perceptible fall in this value for wider separating distances. Tedin decided that the wind was responsible for carrying this small amount of pollen and that a certain number of insects making long flights could also have transmitted it.

With the exception of the broad bean, the Leguminosæ do not require large isolation distances. Soy beans give between 1–2 per cent natural cross-pollination in the field. But crossing between plants of alternate rows is only 0·16 per cent[5]. The recent work of H. Crebert[6] has shown that broad beans undergo 7 per cent outcrossing in the field and breeders in Great Britain experience 5–10 per cent natural crossing in their crops. Evidence of the correct spatial isolation is not available. Cross-pollination of french beans is effected by thrips, which often occur inside the flowers[7]. Barrons[8], working in Alabama, found that at 9 yd. apart there was only 2·63 per cent natural crossing in the common bean. In England seed growers consider that in most varieties of beans the cross-pollination is negligible; seedsmen do not generally ask their growers to isolate fields of different varieties. Peas are considered to be self-fertile and only a short distance is required to protect them against crossing. A separation of crops by 40 rods assures complete elimination of cross-pollination.

Investigations on outcrossing among members of the Umbelliferæ lag behind those of other groups. It is customary to allow half a mile between different

varieties of carrots, but there seem to be no definite figures available for other Umbelliferous crops. Parsnip varieties are usually isolated from each other although pollination within the umbel seems to be the rule; it is also customary to isolate celery and parsley varieties. It is therefore surprising to find so little evidence on spatial isolation of these important crops which include herbs of economic importance such as dill, fennel, carraway and anise.

Cucumbers under field conditions undergo 65–70 per cent natural cross-pollination[9]. A spatial isolation of at least 40 rods, or even more, is necessary to eliminate outcrossing between plots of different cucumber varieties. There is little information available concerning the requisite isolation of marrows.

Lettuces have been the subject of a number of investigations. Thompson[10], working in America, grew lettuce plants side by side without protection from insect visitors. He placed the plants "just far enough apart so that the lateral branches of the seed stalks did not touch". Under these conditions there was 1·33–6·22 per cent outcrossing. Under normal field conditions, therefore, the value would be much less. This supports the practice of British growers of lettuce seed crops who do not subscribe to isolation. The sunflower is generally regarded as a cross-pollinated plant, bees acting as the major contaminating agents. Putt[11] has found the amount of natural crossing is *c.* 70 per cent. Satisfactory isolation distances are so far not reported. Information on the spatial isolation of salsify, scorzonera and chicory is lacking. Although endive is a cross-pollinated plant, there has been little research to determine either the extent of outcrossing or the necessary spatial isolation.

Although the tomato flower is a splendid example of a self-pollinating floral mechanism, even this vegetable is not immune from a small amount of outside contamination. Under field conditions there is 2–4 per cent contamination between rows[12]. More recently Currence and Jenkins[13] have shown that 24 ft. between varieties is sufficient to reduce contamination to a negligible amount. Paschenko, who has made a notable contribution to the literature of floral morphology in the tomato, believes that thrips and not wind are the responsible transmitting agents.

The beets, besides the enforced zoning schemes, require isolation to keep varieties in a pure state. The ordinary beetroot is wind-pollinated, although pollination by insects is also possible. Thrips are important pollinating agents of sugar beets. Increasing the distances between plots definitely reduces the danger of crossing. Beyond about 2½ furlongs there is very little contamination, although it is known that the wind carries beet pollen over a distance of more than two miles. In Great Britain commercial practice requires an isolation of 1,000 yd. between the various crops, but "it became increasingly difficult to obtain isolation"[14]. Hedges definitely act as screens and quite considerably lessen crossing between two plots; there is a definite relationship between the height of the hedges and the reduction in outcrossing. Spinach flowers are wind-pollinated, but there are no satisfactory figures available concerning its isolation. Canadian growers allow at least a quarter of a mile between spinach seed fields and try to keep them out of the path of the prevailing winds[14].

All varieties of onions intercross, so that it is necessary to give a spatial isolation of *c.* 40 rods between plots. Insects normally carry out pollination although wind can transmit onion pollen. Canadian growers consider that half a mile is satisfactory, particularly if there are natural barriers such as an adjacent orchard. Similarly it is customary to give leeks an isolation distance of 250 yd. But further investigations on these two crops would be welcome.

Although not a major vegetable seed crop of Britain, sweet corn is gaining in popularity. Wind and gravity are the chief agencies in disseminating sweet corn pollen. Haber[15] has shown that "the degree of contamination varied with the distance from the source of contamination". Contamination is eliminated with a separating distance of more than 23 rods. But there is a record of a blackbird, which had flown four or six miles from the last maize field it had visited, that carried the pollen on its plumage. Trees are useful in reducing contamination from nearby fields. A grove of trees four rods wide between fields eliminates cross-pollination[16]. Canadian growers use a spatial isolation of one mile and preferably with a natural barrier, and in the United States the legal spatial isolation is 40 rods between varieties.

[1] Haskell, G., "Vegetable Seeds and their Production" (in preparation).
[2] Crane, M. B., and Thomas, P. T., *Gard. Chron.*, **121**, 140 (1942).
[3] John Innes Horticultural Institution, 33rd Annual Report.
[4] Tedin, O., *Landtmannen*, **14**, 454 (1931).
[5] Woodworth, C. M., *J. Amer. Soc. Agron.*, **14**, 273 (1922).
[6] Crebert, H., *Der Euchter*, **3**, 360 (1931).
[7] Mackie, W. W., and Smith, F. L., *J. Amer. Soc. Agron.*, **27**, 903 (1935).
[8] Barrons, K. C., *Proc. Amer. Soc. Hort. Sci.*, **36**, 637 (1938).
[9] Jenkins, J. M., jun., *Proc. Amer. Soc. Hort. Sci.*, **40**, 411 (1942).
[10] Thompson, R. C., *Proc. Amer. Soc. Hort. Sci.*, 545 (1933).
[11] Putt, E. D., *Sci. Agric.*, **21**, 167 (1940).
[12] Jones, D. F., *Science*, **43**, 509 (1916).
[13] Currence, T. M., and Jenkins, J. M., jun., *Proc. Amer. Soc. Hort. Sci.*, **41**, 273 (1942).
[14] Imperial Agricultural Bureaux Joint Publication, No. 5.
[15] Haber, E. S., *J. Amer. Soc. Agron.*, **26**, 704 (1934).
[16] Tracy, W. W., U.S. Dept. Agric. Bur. Plant Ind., Bull. 184 (1910).

OBITUARIES

Prof. W. M. Tattersall

WALTER MEDLEY TATTERSALL, who died on October 5, was born on November 8, 1882, the eldest of a family of eight. He was educated at Liverpool College and the University of Liverpool, where he studied under Herdman, and he graduated with first-class honours in zoology at the age of nineteen. He won a research scholarship at Cambridge and looked forward to the opportunity of working there as a postgraduate student, but he was obliged to abandon his intention owing to the sudden death of his father. He took an appointment as naturalist in the Irish Fisheries Department in 1902, and here, as one of a small band of enthusiasts under the inspiring leadership of E. W. L. Holt, he assisted in the exploration of the rich deep-water fauna on the south-west of Ireland. It was during these years that he first began his studies of the Crustacea. Throughout his life he maintained his interest in this group of animals, and our knowledge of them has been greatly extended by the remarkable series of papers he wrote.

In 1909 he succeeded W. E. Hoyle as director of the Manchester Museum, where, in addition to his museum duties, he acted as tutor at the Universities of Manchester and Sheffield to classes arranged by the Workers' Educational Association and regularly took parties of students to Port Erin for courses in marine biology. He obtained his D.Sc. in 1911.

During the War of 1914–18 he enlisted as a private in the Royal Garrison Artillery and saw service in Flanders and France. He was wounded and gassed in 1917, and later received a commission; but he never afterwards enjoyed robust health and for the last ten years of his life he suffered acutely from diabetes.

In 1922 Tattersall was appointed professor of zoology and comparative anatomy at University College, Cardiff, a post he held throughout the remainder of his life. Starting with only a single post-intermediate student, he and the able staff he gathered around him succeeded in building up a flourishing school of zoology, and shortly before the present War he had sixteen honours and nine research students, with sixty students in the final class. As a teacher of zoology Tattersall had outstanding qualities. With a broad and comprehensive knowledge of his subject he combined the gift of inspiring others with his own unquenchable enthusiasm, and by his simple unassuming ways he won the devotion of his students. He insisted on the importance of field work, and for a long series of years he regularly took a party of students to Loch Ine in Co. Cork. Last May, the twenty-first anniversary of his appointment at Cardiff was commemorated, a celebration attended by 121 of his old students, while eighty others sent cables and telegrams of congratulation.

In the course of his busy life at Cardiff, Tattersall was for seventeen years a member of the Court and Council of the National Museum of Wales, and many universities called on his services as external examiner. He edited the natural history volume of the Glamorgan County History and served as president of the Cardiff Scientific Society. At University College he was for a time dean of the Faculty of Science and latterly deputy principal. He had been a member of the British Association for more than thirty years, and there was scarcely a meeting he did not attend. He travelled with the Association to Australia and Tasmania, to Canada and to South Africa, and went to India as delegate to the Indian Science Congress. He served as secretary and recorder to Section D, of which in 1939 he was president-elect.

Tattersall will long be remembered as our foremost authority on certain groups of Crustacea—principally the Isopoda, Amphipoda, Tanaidacea, Mysidacea and Euphausiacea. He was the ideal systematist, careful, thorough and methodical in everything he undertook, and with that well-balanced outlook that sees in taxonomy a means to an end rather than the end itself. Above all he was a prodigious worker. Busily occupied throughout his life with important educational work, he always found time to continue his personal studies, and the steady stream of valuable papers which he contributed over a span of forty years is a monument to his industry and ability. Reports by him are to be found among the results of almost every marine biological expedition which has set out from Great Britain during the present century, and from all parts of the world collections were sent to him for examination and description. He was a naturalist in the best sense of the term; interested as much in the development, habits and distribution of species as in their identification, and taking immense trouble, as in his latest paper on the relict fauna of Ennerdale Water, to find a logical interpretation of his results. In addition to his work on Crustacea he made important contributions to our knowledge of the Cephalochorda and Enteropneusta; he was the first to trace the life-history of the periwinkle, and he described the very remarkable larvæ of the starfish Luidia.

At the beginning of the present War he had just completed the manuscript of a volume on the Mysidacea for Bronn's "Thierreich", and since then he finished a report, to which he had devoted four years of work, on a large collection of Schizopods from the American Museum of Natural History. There are hopes that the Ray Society monograph of British Mysidacea, on which he was recently engaged, is sufficiently advanced for publication.

Tattersall married Olive Selden Attride in 1916, and much of the fruitful work that he was able to undertake in his long years of illness is due to her unremitting care and devotion. As a student of science she was able to give him very substantial assistance, and she herself drew nearly all figures which illustrate his papers.

In Great Britain Tattersall seems not to have been appreciated at his full worth: a foreign zoologist once asked me why it was so. Perhaps it was partly because of his unassuming modesty, his lack of 'push' and hatred of self-advertisement, his contentment in the interest of his subject and in the satisfaction that comes of honest work faithfully performed. But in part, I believe, it was because with new methods of approach in zoology we have been led to underrate—as being old-fashioned—the fundamental work of the naturalist in which Tattersall showed such skill. Yet he has left a permanent mark on the literature of his subject, and his name will be honourably remembered when much that is modern has passed into forgetfulness. His many friends will remember him for his genial, good-humoured outlook on life and personal charm, for his intellectual honesty and for the cheerful courage with which he faced adversity. STANLEY KEMP.

Mr. J. J. A. Jones

WE regret to record the death on November 1 of Mr. John Jenkin Ashton Jones, of the Central Research Department of the United Steel Companies Ltd., Sheffield, and well known in metallurgical research circles.

John Jones was born in 1894, and graduated from Aberystwyth in 1915. Shortly afterwards he joined the Royal Welch Fusiliers and saw active service in the War of 1914–18, during which he was awarded the Military Medal. In 1917 his military service was terminated as the result of wounds, and he joined the Research Department at Woolwich, where he assisted Dr. R. H. Greaves. In conjunction with the latter he presented four papers before the Iron and Steel Institute, of which he became a member in 1920. He was co-author of one other paper, and in his own name contributed six further papers to the Institute.

In 1930 Mr. Jones joined the United Steel Companies Ltd. and, with Dr. T. Swinden, director of research, he took a large part in planning the Central Research Department of that group at Stocksbridge. When the Central Research Department opened he became the manager, a post he held to his death. He leaves a widow and a son and daughter.

Mr. Jones represented the best type of scientific worker, and the quality of his scientific papers needs no elaboration. He did much other valuable work which was not so well known. His quiet yet forceful personality and the multiplicity of his contacts gained him many friends, to whom his many other qualities endeared him. As an example of his modest self-

effacing personality, it may be noted that many who knew him intimately were quite unaware of his distinguished military record. His death will be deeply felt by all who were in contact with him in personal, business and scientific relationships.

We regret to announce the following deaths:

Dr. Cecil C. Jones, president and chancellor of the University of New Brunswick, where he was professor of mathematics during 1906–31, on August 19, aged seventy-one.

Mr. G. W. Littlehales, hydrographic engineer to the U.S. Hydrographic Office during 1900–32, on August 12, aged eighty-two.

Mr. F. S. Marvin, formerly a staff inspector of the Board of Education, and author of works on the relation of science to civilization, on November 14, aged eighty.

Sir William Noble, a director of the General Electric Co., Ltd., and formerly engineer-in-chief of the General Post Office, on November 10, aged eighty-two.

NEWS and VIEWS

A Minister of Reconstruction in Great Britain

The appointment of Lord Woolton as Minister of Reconstruction with a seat in the War Cabinet follows naturally on Mr. Churchill's declaration in his Mansion House speech on November 9 that it was "a definite part of the duty and responsibility of this National Government to have its plans perfected in a vast and practical scheme to make sure that in the years immediately following the War there will be food, work, and homes for all. . . . No party doctrines or party prejudices or vested interests shall stand in the way of the simple duty of providing before the end of the War for food, work, and homes. They must be prepared now during the War. These plans must be prepared and they must come into action, just like when war breaks out general mobilization is declared. They must come into action as soon as victory is won. On this far-reaching work His Majesty's Government are now concentrating all the energies that can be spared from the actual struggle with the enemy." It may, of course, be inferred that the removal of Lord Woolton from a post which he has filled with such conspicuous success is an indication that Mr. Churchill does not expect the food problem again to become acute. It is equally an indication of the Prime Minister's assent to the principle that preparation for post-war reconstruction has become an urgent necessity and of the importance which he attaches to the Ministry of Reconstruction.

Sir William Jowitt, who as Minister without Portfolio has hitherto been "charged with the duties of reconstruction", will assist Lord Woolton, and the introduction of new blood at the Ministry of Health, which has so much to do with housing, in the person of Mr. H. U. Willink, may be a further indication of the importance now officially attached to reconstruction. The Government's acceptance, in principle, of Lord Balfour's demand last week for early legislation to permit the prompt acquisition of reconstruction areas "at prices related to pre-war values" gave the impression that this obvious and essential measure will soon be made law. The further admission drawn from Lord Snell that "the Government accepts the principle of national planning without qualification", and the Barlow Commission's planning proposals with qualifications, is also reassuring; while in reply to a question from Mr. John Parker on November 10 the Prime Minister denied that the vesting in the State of the rights of development in all land outside built-up areas (proposed by the Uthwatt Committee) was barred as a possible subject of legislation in the present Parliament because of its controversial character.

The precise scope of Lord Woolton's work has not yet been explained. It may be presumed to be administrative rather than the originating of policy, and that Lord Woolton will be principally engaged in supervising and co-ordinating the Government's plans for food, work and homes. Lord Woolton may not have as wide a scope as Lord Addison in 1917 for his task in focusing all the departmental activities, but in sorting out priorities and in seeing that all the necessary legislation is prepared, including laying out the structure of the new social security scheme and forcing concrete decisions on physical planning and in housing, there is ample scope for Lord Woolton's active mind and administrative resource. Whether or not his responsibilities extend to demobilization and to all the policies that are comprised in full employment, it is a great asset to have in charge of reconstruction a man free from Party ties, and the path to agreement on a common programme should be easier.

Centenary of Ferdinand R. Hassler, 1770–1843

On November 20, 1843, the death occurred of the Swiss-American mathematician and geodesist, Ferdinand Rudolph Hassler, who was the first superintendent of the United States Coast Survey, now the United States Coast and Geodetic Survey. To-day the Survey is responsible for hydrographic, geodetic, tidal, magnetic and seismological work throughout the whole of the United States dominions from Florida to the Aleutians, but when it was founded the United States only fronted the Atlantic seaboard. The suggestion for the Survey came from the American Philosophical Society, the recommendations of which were adopted by President Jefferson, and it was through the Society that Hassler became connected with it when Congress on February 10, 1807, passed the necessary law. Hassler had only been in America two years then, but he had taken with him a library of more than 3,000 volumes and a good collection of instruments, and it was his interest in science which had led to his contact with the members of the Philosophical Society.

Hassler was born in Aarau, Switzerland, on October 7, 1770, and was the son of a well-to-do watchmaker. At the University of Berne he gained a knowledge of mathematics and surveying and afterwards was engaged on a trigonometrical survey of Switzerland. He married in 1798, and in 1805, owing to the political unrest of the time, joined a party of emigrants who planned to settle in the southern States. On their arrival in Philadelphia the would-be colonists met with various difficulties, but Hassler's scientific attainments stood him in good stead. Hassler's

plans for a coast survey were adopted, and he was appointed to start the work. There was, however, much delay. Having during 1807–9 held a chair of mathematics at West Point Military Academy and during 1809–11 a chair of natural philosophy, in the latter year he was sent by the Treasury to England to purchase instruments. Owing to the War of 1812 between Great Britain and the United States, it was three years before he was able to return to America. The survey was actually started under Hassler's superintendentship in 1816, but two years later he was deprived of his post owing to new regulations which allowed only naval and military officers to be employed. During 1819 he was astronomer to the party sent to settle the north-eastern boundary, but then he was thrown completely on his own resources. For ten years he farmed, somewhat unsuccessfully, in New York State, taught and wrote mathematical text-books. For a time, too, he was employed at the New York Custom House, and then in 1832 when the Survey was reorganized—its work had been practically suspended—he once again became its superintendent. Though sixty-two years of age, he entered upon his work with enthusiasm, assembling the necessary instruments, training assistants and commencing operations in the field. In this work he was engaged until his death at the age of seventy-three at Philadelphia.

Hassler's memory was honoured at the centennial commemoration of the Survey, and in 1929, Prof. Florian Cajori, the historian of science, of the University of California, published his biography under the title "The Chequered Career of Ferdinand Rudolph Hassler". In spite of many troubles—domestic, financial and administrative—Hassler left his mark, and it has been said that "Time has justified the soundness of his ideas", and that "the extension of the survey of the coast to the present day follows his plan, and the field work he carried out more than a century ago is of such high precision that it still forms part of the basic network". As State after State was added to the country, so the work of the Survey extended. Under Hassler's successor, Alexander Bache, the electric telegraph was used in the determination of longitude, and under the third superintendent, Benjamin Peirce, the triangulation was carried from the Atlantic to the Pacific. In the nineteenth century the Survey was responsible for the standard weights and measures; but in 1901 a new department was founded for this work under the title of the United States Bureau of Standards. The centennial celebrations referred to were held in Washington under the presidency of the superintendent, Mr. E. Lester Jones, the President of the United States, Mr. Woodrow Wilson, being among the speakers. A memorial volume was issued, and this contains a portrait of Hassler.

Wellcome Veterinary Research Station

THE Wellcome Foundation has acquired Ely Grange Estate, Frant, Sussex, for the purpose of extending the veterinary research now carried on at the Wellcome Physiological Research Laboratories, Beckenham, Kent. The need for accommodation where experiments can be carried out on farm animals has been felt for some time. The estate will be known as the Wellcome Veterinary Research Station and the resident veterinary surgeon will be Mr. S. L. Hignett, who will be responsible to Dr. R. F. Montgomerie, veterinary research director at the Wellcome Physiological Research Laboratories, where veterinary research, particularly on the laboratory side, will be continued. The full development of the Station at Frant will be delayed until after the War, as the mansion, which will be converted eventually into laboratories, is requisitioned by the Government; but the extensive and modern farm buildings will be occupied and used at once. A start has been made by the acquisition of a herd of pedigree Ayrshire cattle. In addition to the main purpose of the Station, there will be accommodation for the breeding of laboratory animals on a large scale. It is hoped to establish a number of pure lines for this purpose and to do work on genetics in connexion with the breeding of these animals.

Post-War Needs of Universities in Great Britain

SIR JOHN ANDERSON recently stated in answer to a question in the House of Commons that the constitution of the University Grants Committee has been under consideration for some time, and he hopes very shortly to announce the appointment to the committee of a number of new members. As regards the equipment of universities to deal with the post-war situation, the universities themselves have been studying the various problems which will face them after the War. The Committee of Vice-Chancellors and Principals has asked the University Grants Committee to undertake a review of these problems in order to form a considered estimate of the need for increased assistance from the Exchequer. This request will require to be considered as a matter of urgency by the reconstituted Committee; meantime, the universities are being asked to formulate their post-war needs so far as they can be estimated in present circumstances.

Replacement of British Museum's Foreign Books

A GENEROUS offer to replace, so far as possible, the many volumes in the section of non-English books and periodicals which have been destroyed by enemy action in the British Museum has been made by the Allied Governments in London. The offer was put forward by Dr. Philip Argenti, honorary attaché to the Greek Embassy, at a recent meeting of the Books and Periodicals Commission of the Conference of Allied Ministers of Education. Representatives of the Allied Nations pledged their governments to replace, after the War, as a gift, to the best of their abilities, the periodicals and books in their respective languages damaged or destroyed by air attack. The Museum has been invited to submit a list of such periodicals and books to the Commission, classified according to their languages.

The Newcomen Society

THE Newcomen Society met for its annual general meeting on November 10 at the Northampton Institute, London, when the report of the Council for the past year was submitted, and the election of officers took place. The Society has continued to expand, and on September 30 the membership stood at 3,092, irrespective of fifty-five libraries which receive its publications. Owing to the very large increase in membership in North America, the rules of the Society have been amended so that branches overseas can elect their own members and manage their own finances, thus avoiding unnecessary correspondence and expense. The subscription has

been raised from £1 to £1 10s. for those who elect to receive the *Transactions*. The president for the coming year is Mr. William M. Vermilye, of the National City Bank, New York, who has been treasurer of the American branch for some time. In spite of the difficulties due to the War, a good programme was carried through, and the report contains the titles of seventeen papers and addresses which will ultimately be published in vol. 23 of the *Transactions*. Vol. 21 is in the press and it is hoped will be issued shortly. At the close of the business, special reference was made to the unceasing efforts on behalf of the Society of Dr. H. W. Dickinson. After the business was concluded Mr. R. P. Howgrave-Graham gave a lecture on "Engineering in Early Warfare", the devices of centuries ago being illustrated from documents and pictures.

A New Source of Vitamin C

THE *Biochemical Bulletin*, No. 27, May 1943, published by the Sino-British Co-operation Office, includes among other items of interest an article by T. M. Chen, S. Ho, K. M. Hsieh and T. Shen on "A Very Rich Source of Vitamin C: the Wild Fruit of Emblic from India and S. China". It was thought that this wild fruit might be used as a cheap and convenient source of vitamin C for the Allied Armies in this theatre of war. The tree, *Phyllanthus Emblica* L., bears the fruit, which is "fleshly, depressed, globose, ¾ in.–1 in. diameter, obscurely 6-lobed". The juice is very sour and astringent but contains about ten times as much ascorbic acid by indophenol titration as lemon juice, an average figure of 921 mgm./100 ml. juice being given. This is qualitatively supported by guinea pig tests. It is not toxic for humans, who probably utilize it to the same extent as the crystalline vitamin.

Miners' Welfare National Scholarships

THE trustees of the Miners' Welfare National Scholarship Scheme invite applications for a limited number of university scholarships for award in 1944; there are, in addition, a limited number of exhibitions available for award to the most meritorious of the unsuccessful candidates for scholarships. Candidates must be either workers in or about coal mines in Great Britain, or sons or daughters of such workers, and should not normally be less than seventeen years of age on January 25, 1944. Forms of application and full particulars may be obtained from the Secretary, Miners' Welfare National Scholarship Scheme, Ashley Court, Ashtead, Surrey. Applicants for forms must state whether they apply as workers in or about mines or as children of such workers; those who come within both categories should apply as miners. Applicants already at a university should state, when applying for forms, whether they are first-year students. Application forms must be returned by January 25.

Comet Dalmaca

I.A.U. CIRCULAR No. 965 announces that an orbit has been computed for this comet by Mr. Naur from three observations at the Observatory of Bucharest on September 9, 10 and 11. The elements of the orbit are given below.

T	1943 Aug.	21·538 U.T.	
ω	36° 02·0′	}	1943·0
Ω	82 15·1	}	
i	161 15·7	}	
q	0·75812		

From these elements the following ephemeris has been computed. As the orbit has been derived from short arcs, the figures given below cannot be accepted as very accurate. The comet was stated to be mag. 10 on September 18, when its distances from the earth and sun were 0·32 and 0·92, respectively. As it has receded considerably from the earth and sun since that date, it must be a faint object now, probably about mag. 16.

Ephemeris

Date 1943	R.A. h. m.	Dec.	ρ	r
Nov. 16	18 48·2	11° 56′	2·107	1·658
20	18 51·5	12 25	2·229	1·713
24	18 54·6	12 49	2·342	1·764
28	18 58·0	13 10	2·459	1·823

Announcements

PROF. A. V. Hill, secretary of the Royal Society, is to visit India to advise on problems of scientific and industrial research in relation to reconstruction problems and the co-ordination of such research in India with that elsewhere. His tour is being undertaken at the invitation of the Government of India and with the consent of the Royal Society.

SCIENTIFIC men and many others will learn with much pleasure that Prof. Niels Bohr, of the Institute of Theoretical Physics, Copenhagen, has succeeded in escaping from Denmark and has reached Great Britain.

THE Council of the Royal Meteorological Society has awarded the Symons Gold Medal for 1944 to Dr. C. W. B. Normand, director-general of observatories in India. The medal is awarded biennially for distinguished work in connexion with meteorological science.

SIR GEORGE THOMSON, professor of physics at the Imperial College of Science and Technology, London, has been appointed scientific adviser to the Air Ministry. He will be responsible for examining air operations from the scientific aspect, the methods, weapons and equipment employed, and for advising the Air Staff and other Air Ministry departments on these matters. On all questions affecting radiocommunication and radiolocation Sir George Thomson will work in consultation with Sir Robert Watson-Watt, scientific adviser on telecommunications.

MR. GEORGE HURST has been appointed lecturer in mining and mine surveying in the University of Sheffield. The Rockefeller Foundation has renewed its grant to the University of Sheffield of £400 for research in biochemistry for a further year beginning October 1, 1943.

THE Huxley Memorial Lecture of the Royal Anthropological Institute will be delivered by Prof. F. C. Bartlett, professor of experimental psychology in the University of Cambridge, in the rooms of the Royal Society on November 23; he will speak on "Anthropology in Reconstruction".

THE Spanish Cultural Institute at Buenos Aires has recently dedicated a histological laboratory to the memory of Ramon y Cajal; it is under the direction of Prof. Hortegan, one of his pupils.

ERRATUM. In NATURE of November 6, p. 540, col. 2, in the communication signed by Prof. E. F. Burton, the size of the fibre used is given as "approximately 0·7 mμ in diameter"; this should be "0·7 μ".

LETTERS TO THE EDITORS

The Editors do not hold themselves responsible for opinions expressed by their correspondents. No notice is taken of anonymous communications.

J. B. Hannay and the Artificial Production of Diamonds

REFERRING to Dr. C. H. Desch's article on this subject in NATURE of August 7, p. 148, I wish to put certain recollections of my own on record.

During the years 1885–96 my father, the late Lord Rayleigh, was one of the secretaries of the Royal Society, and not infrequently mentioned in the family circle incidents which had occurred in connexion with the Society's business, though of course he never gave the names of referees. In particular he spoke a good deal about J. B. Hannay's claim to have produced diamonds, though he never expressed any personal judgment on the matter. It would not have been in his character to do so, without personal investigation.

Hannay sent to the Royal Society a further communication on the artificial production of diamonds at a much later date than that of his published paper on the subject, certainly later than 1890—perhaps about 1894. It may be in the Society's archives, which are at present inaccessible. My father, as secretary, had to deal with it. He made it clear that among the members of the committee of papers (I believe this committee was in fact the same body as the Society's Council) there was distrust of Hannay's good faith. Rayleigh personally found him plausible. Hannay, he said, wrote that the non-publication of his paper seemed to imply disbelief in his good faith, and that as he had offered to demonstrate the matter he thought that this was rather hard. Rayleigh was inclined to agree that it was hard. In Hannay's earlier work, only very occasional success was claimed, and under these conditions a demonstration would scarcely be practicable. I do not know whether at the later period he claimed uniform success. However, the reason why his offer to demonstrate was not accepted was that it was not thought that any demonstration carried out by Hannay could satisfy the sceptics, and no one seems to have undertaken to repeat the work independently.

Hannay wrote a paper "On the Microrheometer" (*Phil. Trans.*, **170**, 275; 1879) which deals with viscosity. This is commented on by R. E. Barnett (*Proc. Roy. Soc.*, **56**, 259–261; 1894), in a paper inspired by T. E. Thorpe, and communicated by him. Barnett gives a very unfavourable analysis of Hannay's work. Since Barnett's paper is not at present easily accessible, owing to libraries having put the volumes of periodicals away for safety, I think some extracts from it may fittingly be quoted.

Hannay gives the rate of flow of various liquids through a capillary tube of stated dimensions. These measurements are not reduced by him to give absolute values of viscosity and thus to admit of easy comparison with the measurement of others, but Barnett points out that all the necessary data are given for such a reduction, which he proceeds to make. He says: "On comparing these results with the values given by Poiseuille Slotte, Sprung, and Thorpe and Rodger as tabulated below (II), it will be seen that Mr. Hannay's observations yield discordant, and indeed, utterly absurd, values for the viscosity of water. At 0°, for example, the viscosity would appear to be below that of any known liquid, and at 6° it becomes *nil*.

"As a matter of fact, it is physically impossible to pass a volume of water such as Mr. Hannay employs under a pressure of 1 m. of water through a capillary of the dimensions given in the time recorded. At 20°, for instance, the time of flow required under these conditions would be about 4600 seconds instead of 131·3 seconds as stated.

"In the light of these results, it would seem to be premature to discuss Mr. Hannay's observations on saline solutions, or to criticise the generalisations he deduces from them."

I have not been able to discover that Hannay made any attempt to reply to this apparently very damaging criticism.

He also wrote a paper on the metallurgy of lead which was read before the Royal Society on April 15, 1893 (see the *Proceedings*), but not published. This paper was, I believe, judged not to have been written in good faith. It is almost certainly still in the Society's archives.

I think that attention should be directed to these facts which, though perhaps not decisive of anything relating to the diamond problem, may nevertheless help in forming a provisional judgment. If Hannay was after all right, they will at least be a contribution to scientific history. The incident about viscosity seems to show clearly enough that his critics had something more than prejudice to go on.

RAYLEIGH.

Terling Place,
Chelmsford.
Oct. 23.

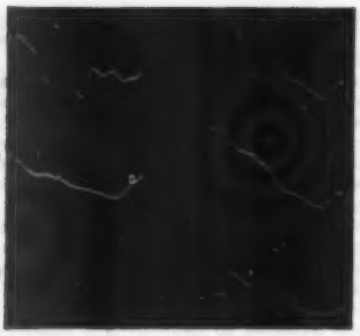
Single-Fibre Response from an Intact Animal

IT is rather difficult to obtain electrical records of the activity of a single nerve fibre, because there are usually present some hundreds of other nerve fibres the contribution of which must be eliminated, and because the shunting of the active fibre by inert tissues or tissue fluid reduces the available action potential to vanishing proportions. It is therefore essential in most cases that the recorded fibre be fairly well isolated both physiologically and electrically, and we are not aware that any records have hitherto been published showing single fibre responses obtained from an animal which has not been dissected nor operated upon in any way.

The median giant fibre in the nerve cord of the common earthworm, *Lumbricus terrestris* L., is especially favourable for such a record, for it may be physiologically isolated from other structures and it has such a large cross-section area that a fair amount of shunting may be tolerated[1].

If a normal lively worm is used the nerve activity is accompanied by muscular action which complicates the record, but if the worm lies in a glass tube just large enough to contain it, it remains quiescent and the record is fairly simple. The nerve is stimulated by a shock applied to the anterior end of the worm, and the record is obtained from leads passing through the glass tube and making contact with the worm's body in the middle region. These leads connect through a balanced amplifier to a cathode ray tube with time base synchronized with the nerve stimulus.

The first record shows the effect of a just threshold stimulus; the least diminution of stimulus gives the



second record. The response therefore exhibits the all-or-none relation to stimulus-strength, it also persists unfatigued by a tetanus of 20 per sec. and is conducted at the same rate as the impulse in the median giant fibre of the nerve cord. This result therefore strongly favours the view that the wave in record (1) is the action potential of the median giant fibre or of structures connected therewith. The grounds upon which we believe that the record does contain the action potential of this fibre itself are these.

The area of cross-section of the median fibre is 0·01 sq. mm., that of the worm filling the glass tube 20 sq. mm. Assuming the mean specific conductivity of the worm to be half that of the giant fibre, the electrical shunting would reduce the recorded wave to 1/1,000 of the nerve membrane potential of 0·1 volt. Hence the recorded wave should be 0·1 mv., which is seen to be of the right order from record (3), which gives a calibration wave of 1,000 cycles at 0·1 mv., peak-to-peak.

The worm is now withdrawn from the tube, opened by a longitudinal incision, and the nerve cord is carefully dissected out and placed in Ringer's fluid. The carcass is replaced in the tube and stimulated as before, but the record shows no wave and is not here reproduced. The carcass is now withdrawn and the nerve cord replaced in it and re-inserted in the tube. The physiological connexions from nerve to worm are now, of course, all destroyed, but the electrical shunting is approximately the same as initially, and records (4) and (5) show the effects of a shock just above and just below threshold, with recording conditions the same as in record (1). The main wave of the first record is repeated, but the subsequent small waves are absent. Finally the carcass was removed, and the nerve cord alone stimulated to give the last record taken at much reduced amplification.

Now this last record is certainly the wave from the median giant fibre, as may be shown by microdissection[2]. Thus the wave in record (4) is clearly the same, but more highly shunted by the carcass. Hence the main wave of record (1) is simply the action potential of the single median giant nerve fibre, and this is followed in the intact animal by other waves with which we are not here concerned.

W. A. H. Rushton.
H. B. Barlow.

Physiological Laboratory,
Cambridge.
Oct. 24.

[1] Eccles, J. C., Granit, R., and Young, J. Z., *J. Physiol.*, 77, 23P (1933).
[2] A paper including the identification of potential waves in the worm's isolated cord is being prepared by one of us.

Osmotic Regulation in *Sabella pavonina*

The Sabellidæ are one of the few families of Polychæte worms which have successfully penetrated into fresh water. One of us has previously observed at Loch Ine, Co. Cork, that *Sabella pavonina* Sav. occurs in places in which, at low tides, it is subjected to conditions of low salinity. It seemed of interest to know whether this worm has any power of 'osmotic regulation', and whether the highly developed pair of thoracic nephridia play any part in such regulation. We have carried out some simple experiments on these points.

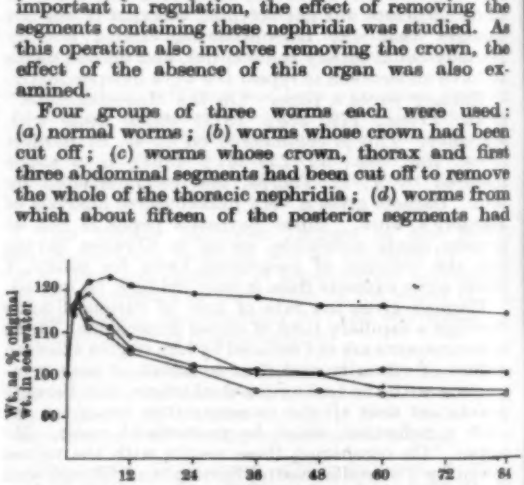
Active regulation in a marine invertebrate may be recognized by following the changes in weight which result from placing the organism in dilute sea-water. If the animal can regulate, it will retain its original weight or regain it within a short period. In the following experiments changes in weight of Sabella in different concentrations of sea-water have been observed.

Preliminary experiments showed that it was possible to dry Sabella while still in its tube and obtain consistent weighings in a series of dryings. It was also shown that the weight of the tube did not alter significantly in twenty-four hours on being moved from sea-water to tap-water. All experiments were consequently carried out with the worms still in their tubes after these had been trimmed and any attached growths removed. The water in which the worms were kept was changed every twelve hours. The temperature varied between 15·2° and 17·6° C.

To study the capacity of the worms to regulate, the change in weight of individual worms in normal, 80, 60 and 40 per cent sea-water was followed for thirty-six hours. In 80 per cent sea-water the worms regained their original weight within twenty-four hours; in 60 per cent sea-water the worms rapidly deteriorated in condition, shed their crowns and did not return to their original weight; in 40 per cent sea-water the worms died within twenty-four hours. It may therefore be concluded that Sabella has only limited powers of regulation when transferred suddenly to diluted sea-water.

In order to see whether the thoracic nephridia are important in regulation, the effect of removing the segments containing these nephridia was studied. As this operation also involves removing the crown, the effect of the absence of this organ was also examined.

Four groups of three worms each were used: (*a*) normal worms; (*b*) worms whose crown had been cut off; (*c*) worms whose crown, thorax and first three abdominal segments had been cut off to remove the whole of the thoracic nephridia; (*d*) worms from which about fifteen of the posterior segments had



●, worms without thorax; ×, worms without crowns; ○, worms without tail segments; ⊕, normal worms.

been removed; these were to act as a control against possible effects due to cutting the worms.

These various amputations were performed about sixty hours before the beginning of the experiments, and the worms were kept in running sea-water until required. All experiments were carried out in 75 per cent sea-water. The worms in each group gave consistent results.

The variation in weight of these groups of worms with time is shown in the accompanying figure. It will be seen that while normal worms, those lacking their crowns and those lacking the posterior end all regain their original weight within 36 hours, the worms lacking the thorax show relatively little recovery within 84 hours. It therefore appears probable that the large thoracic nephridia play an important part in the 'osmotic regulation' of *S. pavonina*.

Our thanks are due to the director and staff of the Marine Biological Station at Plymouth for their hospitality to us while carrying out these experiments.

D. W. EWER.
R. F. EWER.

64 Queens Road,
Richmond, Surrey.
Oct. 10.

Siderocytes in Mammalian Blood

FOLLOWING the work of Grüneberg[1], I decided to investigate the possibility that the siderocyte might be a degenerating cell, and that the iron might be catabolic in nature. Investigations in stored blood yielded the following results and conclusions.

Siderocytes appear in large numbers in stored blood of cats, dogs and human beings. Apparently all the cells go through a phase as a siderocyte, and it is possible to demonstrate that the siderotic granules are extruded from the red cell. Concomitantly there is a fall in total blood pigment of between 2 and 7 per cent and a corresponding increase in non-haemoglobin plasma iron and a bilirubin-like substance. The change is affected by the availability of oxygen, inhibited by storage at low temperature, and accelerated by heat and chemical agents. Phenylhydrazine is one of these agents. The change can be effected once only, and after the granules have been extruded the erythrocyte becomes susceptible to phagocytosis.

Carbon monoxide produces a partial inhibition, but the presence of leucocytes does not influence the production of the siderotic material. Fragility changes also occur, and resistant cells resembling "target cells" (Barrett[2]) appear after the extrusion phenomenon.

It is concluded that the siderocyte is not essentially a young cell; that it is probably the stage before the cell is removed from the circulation; that it probably appears in the blood of all mammals; that the iron is catabolic, and that it is closely related to, if not identical with, the 'easily-split' blood iron studied by Legge and Lemberg[3].

A detailed account of the work will be published elsewhere.

ROBERT A. M. CASE.

Department of Pathology,
The Medical School,
University of Birmingham,
Birmingham.

[1] Grüneberg, H., NATURE, 148, 114 (1941); 148, 469 (1941); *J. Genet.*, 44, 264 (1942).
[2] Barrett, A. M., *J. Path. Bact.*, 46, 603 (1938).
[3] Legge, J. W., and Lemberg, R., *Biochem. J.*, 33, 754 (1939).

Fragility of Erythrocytes in Hypotonic Saline

AN interesting point in connexion with hæmolysis is the variation in the resistance of erythrocytes obtained from the different species of animals towards a particular hæmolysin. It was Rywosch[1] who first attempted a sort of generalization in this connexion by pointing out that the series obtained by writing down the names of common laboratory animals according to the order of resistance of their erythrocytes to hypotonic saline is just the reverse of that obtained by ranging them according to their resistance to saponin hæmolysis. Various suggestions were put forward from time to time to explain this inverse relation, which suggested the possibility of the existence of some factor within the corpuscles which operated in a reverse manner with respect to the lysins concerned.

Subsequent work on the subject, however, showed that Rywosch's contention is neither strictly true for all hæmolysins[2], nor is it applicable to all species of erythrocytes[3]. While working on the fragility of the erythrocytes obtained from some common laboratory animals, in hypotonic saline, it struck us that some erythrocytes known to be of very small size, such as those of sheep and goat, were very fragile, while others of bigger size, such as those of man, dog, etc., were far more resistant.

A closer examination of our data showed that the fragility of the erythrocytes of the species of animals studied, namely, guinea pig, human being, monkey, dog, rabbit, buffalo, ox, cat, sheep and goat varied inversely as their respective average diameter. It remains to be seen whether this relation is a general one and true for all species of erythrocytes.

A. C. ROY.

School of Tropical Medicine,
Calcutta. July 30.

[1] Rywosch, *Pflüger's Arch.*, 116, 229 (1907).
[2] Ponder and MacLachlan, *Brit. J. Exp. Path.*, 8, 267 (1927).
[3] Ponder, Salsow and Yeager, *Biochem. J.*, 24, 805 (1930).

Determination of Ascorbic Acid in the Presence of Sulphur Dioxide

WHEN an equal volume of 3 per cent hydrogen peroxide is added to a slightly acidified ascorbic acid solution, no appreciable effect on the indophenol titration value is observed, unless iron or copper salts are present. The end-point is a permanent pink colour deepening very slowly on standing. With sulphited fruit and vegetable extracts the sulphur dioxide is converted into sulphuric acid, and the true ascorbic acid value is rapidly obtained on titration. When lesser quantities of peroxide are used, the titration values are slightly lower, and the pink colour deepens more rapidly. Apparently, re-oxidation of reduced indophenol takes place during the titration, along with reduction of the reformed indophenol by ascorbic acid still present. When 1·5 per cent peroxide is present in solution, this effect is negligible. The method has been used successfully for the last three years.

Full details of these observations will be published elsewhere.

L. F. LEVY.

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Department of Agriculture and Forestry,
Joubert Street North,
Johanneesburg. Aug. 16.

Constitution of Calycanine

Some time ago, on the suggestion of Prof. A. R. Todd, calycanine was examined by X-ray methods[1,2] in order to decide whether a constitution originally suggested by Barger, Madinaveitia and Streuli[3] for a molecule $C_{14}H_{10}N_2$ is in harmony with the crystallographic symmetry and the unit cell dimensions. That investigation established the approximate dimensions of a monoclinic unit cell as $a = 13{\cdot}7$ A., $b = 4{\cdot}45$ A., $c = 9{\cdot}7$ A., $\beta = 107°$, and showed that the space group is $P2_{1/a} - C_{2h}^5$, provided that a few very weak reflexions are neglected. If these reflexions are taken into account, it was suggested that the above cell should be regarded as a pseudo-cell, the true unit cell having a doubled c-axis, $2 \times 9{\cdot}7$ A. Fairly detailed suggestions were advanced as to the probable crystal structure, but the chemical synthesis which Prof. A. R. Todd intended to carry out has not been completed because of the War.

Recently, Prof. Todd pointed out to us that a totally different molecule $C_{21}H_{15}N_3$ has been proposed by Manske and Marion[4], and suggested that our X-ray data might enable us to decide unequivocally whether this new molecule can be regarded as a possible alternative to the molecule $C_{14}H_{10}N_2$. We have therefore re-examined our original X-ray data, and have supplemented it with new photographs from different crystalline specimens, with the following results.

The dimensions of the monoclinic (pseudo) cell have been determined more accurately as $a = 13{\cdot}7$ A., $b = 4{\cdot}45$ A., $c = 9{\cdot}8$ A., $\beta = 110{\cdot}5°$. The density of calycanine is 1·34 gm./c.c., so that the mass of this unit cell is 750×10^{-24} gm. The masses of molecules $C_{14}H_{10}N_2$ and $C_{21}H_{15}N_3$ are 379×10^{-24} gm. and 510×10^{-24} gm., so that this cell would contain $\frac{750}{379}$ or $\frac{750}{510}$ molecules, that is, 1·98 or 1·47 molecules, according as one formula or the other is selected. Thus within the accuracy of our measurements this cell may contain either two molecules $C_{14}H_{10}N_2$ or $1\frac{1}{2}$ molecules $C_{21}H_{15}N_3$. If this is the true unit cell, the second alternative can be rejected, since a unit cell cannot accommodate a fractional number of molecules.

In general, an approximate determination of the cell dimensions and density would suffice to decide between alternative molecular formulæ; in this case, however, it happens that a cell with doubled c-axis (as suggested in our original examination of calycanine[1,2]) would contain a whole number of molecules (four or three) for either of the molecules proposed. It therefore becomes necessary to consider very carefully the significance to be attached to the additional weak reflexions which originally led us to propose a true unit cell with doubled c-axis.

Our new photographs again show additional weak reflexions, but, partly because of the shape of these diffraction spots, partly because of their positions in the oscillation photographs, and partly because of the difficulty we have found in systematizing their appearance in photographs from different crystalline specimens, we now incline strongly to the view that they arise from one or more differently oriented crystalline fragments attached to, or grown as part of, the main crystal exposed to the X-ray beam. Because of the peculiar optical properties of calycanine[2], such crystalline fragments are not detected by the usual microscopic examination. The possibility of a true unit cell with doubled c-axis is not definitely excluded; but we do not now consider that there is any very definite evidence for its existence, and if the *true* unit cell has $c = 9{\cdot}8$ A., then the formula $C_{21}H_{15}N_3$, suggested by Manske and Marion, is apparently excluded, while the formula $C_{14}H_{10}N_2$ suggested by Barger, Madinaveitia and Streuli and by Prof. Todd is acceptable. The detailed discussion[1,2] of the probable crystal structure is unchanged in essentials, though slightly modified in detail, if the small cell ($c = 9{\cdot}8$ A.) is the true unit cell.

If, however, we still take the cautious view that the true cell may have the doubled c-axis, it is still necessary to consider under what conditions three molecules ($C_{21}H_{15}N_3$) could be accommodated in it. It appears that this would necessitate the selection of *either* a triclinic space-group *or* a monoclinic space-group without $\{h0l\}$ halvings, so that in either case well-established features of the crystal symmetry must be left out of account. No such difficulties arise, of course, in placing four molecules ($C_{14}H_{10}N_2$) in the larger cell.

We may summarize by saying that all the evidence, whether direct or circumstantial, is satisfactorily explained if the molecule is $C_{14}H_{10}N_2$; but that a molecule $C_{21}H_{15}N_3$ can only be brought into harmony with observation by the adoption of a series of unusual and unlikely suppositions which still leave unexplained certain prominent features of the experimental data.

A. Hargreaves.

Physics Department,
College of Technology,
Manchester 1. Oct. 1.

[1] Hargreaves, A., thesis for Ph.D. degree, University of Manchester (1940).
[2] Hargreaves, A., and Taylor, W. H., *J. Sci. Instr.*, **18**, 138 (1941).
[3] Barger, G., Madinaveitia, J., and Streuli, P., *J. Chem. Soc.*, 510 (1939).
[4] Manske, R. H. F., and Marion, L., see Craig, *Ann. Rev. Biochem.*, **11**, 572 (1942).

Non-Solar Planetary Systems

Observation has revealed the existence of at least two planetary systems attached to binary stars very near our solar system[1]; and the suggestion that there are numerous planetary systems in the universe gains ground. It is interesting to examine the different conflicting theories of the origin of the solar system in the light of these observations.

On the tidal theory of Jeans and of Jeffreys, planetary systems originate only at the rate of about one per 5,000 million years. Taking the generally accepted short time-scale for the age of the universe —an interval between 10^9 and 10^{10} years—we find that there can be at most two planetary systems in the galactic system, on Jeans's theory. The probability of collisions is still less on Lyttleton's binary star collision theory[2], and there is scarcely any chance for the formation of a planetary system.

On Banerji's Cepheid theory[3], in which the solar system is supposed to originate from the oscillatory instability of a Cepheid due to the gravitational attraction of a passing star, the probability of formation is very much greater, as a grazing or even close encounter is not necessary in this theory. In fact, Banerji concludes his theory with the following words: "One conclusion seems to be irresistible. If the theory be correct in its essentials, there may be more planet-

ary systems than at present supposed". The recent observations support Banerji's conclusion.

The detection of planetary systems in binary stars also lends support to the Cepheid theory of the origin of binary stars recently advanced by me[4]. Owing to radiation of energy and consequent increase of angular velocity, a Cepheid was supposed to break up into a double-star system. There is a chance of planets being formed from the filament connecting the two stars.

H. K. SEN.

Dept. of Mathematics,
University of Allahabad.

[1] See NATURE, 152, 66 (1943).
[2] Lyttleton, R. A., *Mon. Not. Roy. Astro. Soc.*, 98, 536 (1938).
[3] Banerji, A. C., *Proc. Nat. Inst. Sci. Ind.*, 8, 173 (1942).
[4] Sen, H. K., *Science and Culture*, 7, 582 (1941–42).

Propagation of Potatoes

DR. L. G. G. WARNE[1] is to be thanked for pointing out Loudon's writings on this subject. The works of J. C. Loudon (not Louden) indeed contain references to emergency methods of potato propagation which recent authors in several countries had thought to be new, even if these authors recognized approximations to some of these methods among the practices of their more economical forefathers. Thus already in the first edition of "An Encyclopedia of Gardening", the date on the title page of which is given as 1822, there appear in one form or another all the notes and quotations given by Dr. Warne[1] from the 1871 edition, while again in the first edition of "An Encyclopedia of Agriculture" (1825) Loudon mentions among means of propagation having strenuous support in some quarters "on the ground of experience . . . small cuttings, sprouts, shoots, or even only the eyes or buds".

Three points call for further comment:

(1) Following a later edition of "An Encyclopedia of Gardening", Dr. Warne writes, "the sprouts generally found on store potatoes in spring may, when carefully planted in loose well-prepared soil, be made to yield a crop"—whereas the corresponding remarks in Loudon's first edition read, "the sprouts which are generally found on store-potatoes in spring, and picked off and thrown away as useless, *will*, when carefully planted in loose well-prepared soil, *yield a crop*; and this crop will be fit for use a little sooner than one produced from cuttings or sections of the same tubers" (the italics are mine). In this connexion it may be added that my own tests with detached sprouts[2] have been successful again this year.

(2) Dr. Warne further quotes from Loudon, "In making the sets or sections reject the extremes or watery end of the tuber" (extreme is in the singular in both the 1822 and 1850 editions of "An Encyclopedia of Gardening"). This is the antithesis of the basis of the widely publicized Russian method which expressly advocates use of the rose or 'top' end as being the most active part of a large tuber. However, after the removal of this end and, with it, of the dominant sprouts which are also the most active in the production of growth-retarding substance[3], sturdy productive shoots may be obtained also from the 'heel' (proximal) end of the tuber as well as from the lateral eyes.

(3) Scientific literature, however old, can scarcely be dismissed as 'dead' unless it is wholly superseded or proved to be ill-founded. Nowadays, with the rapid strides and great expansion of the plant sciences, it has become practically impossible for even the most active exponent to 'keep up' in more than an ever-narrowing field of specialization; yet many workers have, of necessity or because they feel it to be their duty, from time to time to go outside their own immediate field. All the more easy, then, to miss pertinent references and repeat the work of others unnecessarily.

NICHOLAS POLUNIN.

New College,
Oxford.

[1] NATURE, 152, 450 (1943).
[2] *Gard. Chron.*, Ser. 3, 113, 36 (1943); NATURE, 151, 587 (1943).
[3] *Amer. J. Bot.*, 29, 558 (1942).

International Languages

RECENT references to international languages in NATURE bring home the necessity of a more thorough inquiry into their possibilities, and into the causes that have so far precluded their wide use. There can now be no doubt that artificial international languages have been constructed that can be learnt in a very small fraction of the time required by any natural language. In spite of this, their anticipated use in international communication has not become general.

A common reason given for their adoption is that they can serve as a tool for international organizations. It is here that the barrier to their use is apparent, since for the last generation international organization generally has been under a cloud.

If after the War we put aside the national rivalry of the last interbellum, its place will need to be taken by international organizations of a robuster nature than hitherto, including both organs of government and cultural international societies. These, if they are based on continuous popular activity, will need a language for their use. (It is less certain that specialized international vocations, such as trade in defined channels, will create a demand for an international language, and the same probably applies to occasional conferences and to the study of foreign countries in detail.) Which international language is to be used must depend on the users. The language for a European or American-European federation might well consist of roots from European languages. A union centred on the English-speaking peoples might well use one based on English. It is conceivable that several might be in use simultaneously in the parliaments of different federations or by different cultural organizations. In view of the ease with which they are learnt, even this would be a gain on the present position, while it would also provide an experimental basis for future work on international languages.

But if one international language is to receive enduring and universal recognition, we require a stable international political and cultural balance, and to know something of the relative importance of the different national cultures therein. How far is this about to be realized? At present we can make some estimate of the future importance of some of the protagonists of this War. Only to a less extent can we foretell the importance of the countries of Asia, South America and Africa. Is it possible to make a reasonably good forecast, to get it accepted, and so to decide the type of international language likely to secure lasting adoption?

E. T. HARRIS.

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Bolton, Lancs.

James Prescott Joule and the Unit of Energy

ALTHOUGH it appears from earlier letters[1] that no definite agreement can be reached about the pronunciation of 'Joule', the following points may be of interest concerning a possible origin of the name and of its different pronunciations. According to A. Schuster and A. E. Shipley[2]: "Joule's name appears to be derived from 'Youlgrave', a village in Derbyshire where his family originally resided". It would, perhaps, be more correct to say that both 'Joule' and 'Youlgrave' had a common origin, the former in the English or Scandinavian personal name 'Iola', the place-name then meaning 'Iola's grove'. A. Mawer and F. M. Stenton[3] give this meaning, though E. Ekwall[4] suggests instead, 'yellow grove'.

Various early forms of the place-name have been noted; for example, 'Yolegrave' (1259) and 'Jolgreve' (fourteenth century), and there are many more recent forms. Indeed, the Rev. P. Hadfield, vicar of Youlgreave, has kindly informed me that he believes there are about forty different spellings to be found in the registers and old churchwardens' accounts, a few examples being 'Yolgreave', 'Yolegrave', 'Yoolgrave' and 'Yoolegrave'. These forms seem to indicate variations in pronunciation. At present 'Youlgreave' is pronounced as in 'pool' and 'grave', though the inhabitants who speak the dialect pronounce it 'Yolgrav', as in 'doll' and 'have'—this on the authority of Mr. Hadfield. He states, further, that between 1750 and 1790, the name 'Joule' is found frequently in the registers always with that spelling. He does not say whether he has carried his investigations back to an earlier date. The Joule family had a mill at Alport in Youlgreave parish, and about twelve years ago a person named Joule visited Youlgreave; he claimed to be a descendant of the original family and was writing a book thereon.

Finally, Mr. Hadfield gives the pronunciation of the personal name as 'Jole', but himself thinks there is no direct connexion between the names 'Joule' and 'Youlgreave'.

K. R. WEBB.

Chemistry Department,
University College,
Southampton.

[1] NATURE, 152, 354, 418, 479 (1943).
[2] Schuster, A., and Shipley, A. E., "Britain's Heritage of Science" (second edit., 1920), 40.
[3] Mawer, A., and Stenton, F. M., "Introduction to the Survey of English Place-Names" (1924), 104.
[4] Ekwall, E., "The Concise Oxford Dictionary of English Place-Names" (1936).

IF the desire is to pronounce the name as it was pronounced by the family and by the friends of Dr. Joule, there can be no doubt it is 'Joole', so as to rhyme with cool, tool or rule. Professors of the University of Manchester, in the 'eighties of last century, such as (Sir) Henry Roscoe, Balfour Stewart, (Sir) Arthur Schuster and Osborne Reynolds, all friends and some close friends of Dr. Joule, all pronounced his name in this way. Forty years ago, when as chairman of a committee for erecting a memorial to Dr. Joule in Sale Park, I met his son, Mr. B. A. Joule, he told me 'Joole' was the right pronunciation, and that in old family deeds the name was written 'Youle', like the name of the village Youlgreave in Derbyshire in which the family lived. It would be interesting if the upholders of the pronunciation 'Jowl' would cite their authorities.

It may be worth recording the opinions of Mr. Joule as to the published photographs of his father. The beardless face at forty-five years of age in the engraving in the memoir by Prof. Reynolds he thought too long, while the bearded face published by NATURE and reproduced in vol. 1 of Joule's "Scientific Papers" he thought good. A still later photograph by Lady Roscoe, said by Reynolds to be "particularly good", is reproduced in Sir Henry Roscoe's "Life and Experiences" (Macmillan, 1906).

C. H. LEES.

Greenacres,
Tonbridge.
Nov. 3.

THE workers in physics and engineering, respectively, in the University of Edinburgh, who were contemporary with Joule, were Tait and Fleeming Jenkin. Tait was a perfervid supporter of correct pronunciation of proper names: witness his joke regarding his fellow pupil at the Edinburgh Academy, Tate, afterwards archbishop, as a man who did not know how to spell his own name.

In the course of a prized twenty-year fellowship with Tait, wherein Joule and his work were referred to with at least annual frequency, the pronunciation I heard Tait use was invariably that which rhymed with 'pool' or 'cool'. There can be no doubt that this was Joule's own, I feel sure.

The testimony of relatives of Fleeming Jenkin would be of much value.

W. PEDDIE.

The Weisha,
Ninewells,
Dundee.

"Timbers of the New World"

IN his review of Record and Hess's "Timbers of the New World"[1] Mr. Alexander L. Howard devotes half of a long paragraph to a mild reproof of the authors for saying something which actually they never said. He writes: "The authors state '*Swietenia* [is] the source of the only and true mahogany', which pronouncement may be correct, and also may not". The text (p. 366) reads: "*Swietenia*, the source of the original or true mahogany".

There is enough evidence produced (p. 369) that the name mahogany was originally (1671) and still is applied to a tree which since 1760 has been known to science as *Swietenia*. The expression "original or true" was meant to convey the meaning that "true" mahogany is the kind to which the name mahogany was first applied, just as the orginal or true cedar is *Cedrus*. Thus it is only through misquotation that a mere statement of fact opens "a very controversial subject". The senior author has publicly expressed his opinion on this subject, but not in "Timbers of the New World".

SAMUEL J. RECORD.

Yale University,
School of Forestry,
New Haven, Connecticut.
Aug. 30.

[1] NATURE, 152, 144 (1943).

THE NEW ALGEBRAS

PROF. E. T. WHITTAKER'S presidential address to the Royal Society of Edinburgh, delivered on October 25, on "The New Algebras and their Significance for Physics and Philosophy", contains a characteristically lucid account of the main features of non-commutative algebra and its application to modern physics. Its significance for philosophy follows perhaps by implication; but it is to be regretted that, presumably through limitation of space, this interesting aspect of the subject received no specific treatment.

It is appropriate that the occasion of the address should fall almost exactly a hundred years after the discovery of quaternions by Hamilton, for this event, as Prof. Whittaker points out, marked the beginning of the emancipation of algebra from the confines of classical ideas, according to which algebraic symbols necessarily obeyed the rules of numbers. Quaternions were devised to represent *operations* (actually operations of spatial rotation, but the general principle involved is capable of much wider application), and the order of performance of two operations, unlike the order of multiplication by two numbers, has in general an effect on the result obtained. In the developments of the new idea, such as Boolean algebra, Pierce's logic of relatives, Whitehead and Russell's logic, and Cayley's matrix algebra, the symbolism traditionally employed for elementary processes with numbers is adopted for different, though somewhat analogous, processes with operators, so that, for example, abC, which in classical algebra stands for the product of a, b and C and is identical with baC, stands in operational algebra for the operation b performed on C and the operation a on the result. It is not, in this case, normally equivalent to baC.

Prof. Whittaker gives some interesting examples of this generalization of symbolic processes, and then introduces the conceptions of modern physics in which scope has been found for its application. The older physics sought to interpret physical events in terms of moving mass-points, and for this interpretation the algebra of numbers was adequate. The refined experiments now possible, however, show that such an interpretation is not admissible for the extremely small entities with which modern physics is concerned. We can no longer think of those entities as particles. "We have no right to postulate the existence of entities which lie beyond the knowledge actually obtainable by observation, and which have no part in the prediction of future effects. Thus the classical concept of a particle must be discarded; in its stead there has been introduced a new fundamental element in the description of the external world, which is called a *state*". States are "events which extend over more than one point of space and more than one instant of time and which yet are *ultimate* events; that is, they cannot be analysed into anything simpler than themselves".

For the representation of states, numbers are inappropriate. The position and momentum of an ultimate physical entity can no longer be regarded as separate quantities, each specifiable by its intrinsic numerical measure. They have to be taken together and represented by a joint symbol, and the problem is to find symbols the rules of manipulation of which fit them to represent the physical situations which actually occur. It turns out that a new algebra of the type introduced by Hamilton, in which 'multiplication' is not commutative, meets the case; it is the matrix algebra of Cayley. This algebra "is, in fact, the symbolism appropriate to things that cannot be measured exactly", although, of course, all observable results obtained by its use must agree with the facts of observation.

Prof. Whittaker gives an example to show how the idea of an operator may be regarded as an extension of the idea of an ordinary number, thus justifying the use of the word 'multiplication' for what are essentially two different processes. In this connexion an illustration occurring in Kelland and Tait's "Introduction to Quaternions" is worth recalling. (Incidentally, Prof. Whittaker speaks appreciatively of Tait's efforts to make known the importance of quaternions.) The extension of the idea of multiplication from whole numbers to fractions involved a generalization as difficult to understand in its day as the extension to operations now is. Originally, multiplication implied a process of addition; to multiply by 3 was to add three numbers together. 'Multiplication' by $\frac{1}{3}$, however, is in no sense an addition, and the result is, in fact, to give a smaller number. This is, in essence, as paradoxical as the non-commutability of matrix multiplication.

N.Z. DEPARTMENT OF SCIENTIFIC RESEARCH

THE seventeenth annual report of the Department of Scientific and Industrial Research, New Zealand, covering the year 1941–42, includes the Minister's statement, the secretary's report, and reports of the various research committees of the Council, on research work at the agricultural colleges, on the work of the Dominion Laboratory, the Dominion Observatory, the Dominion Physical Laboratory, and the Geological Survey, as well as of the Magnetic Observatory, Christchurch.

The Department's activities have continued to be concentrated on problems arising out of the War, but both the Dominion Physical Laboratory and the Radio Development Laboratory have been established in improved buildings and provided with additional skilled staff to give greater assistance to the three Fighting Services and the munitions industry. Important defence scientific units have been established at the University of Otago, and at Auckland and at Canterbury University Colleges. The first commercial dehydration plants for butter, vegetables and meat came into operation during the year, and the plants are giving very satisfactory dried foodstuffs, largely because of the scientific effort put into their design and to previous testing on pilot plants by the staff of the Department. Investigations have been extended to examination of the raw materials used, their pre-treatment to conserve their food values and vitamin contents, and to their packaging in a form suitable to retain high quality when used as army rations by troops operating in difficult field conditions. Work on an up-to-date fruit dehydrating plant is well advanced.

Maps showing the soil types occurring in the North Island have been completed, and, based on these maps, others showing soils which will respond to lime treatment in different degrees have been prepared. A map of the areas suffering from erosion in the mountainous region of the South Island has been completed, and soil surveys have been made of three

of the important linen flax districts of Otago. During the year a Building Research Committee was established by the Department which is giving consideration to the numerous problems which will arise and require investigation in connexion with materials necessary for the construction of houses after the War. The Department's activities have been closely associated with similar activities in Great Britain, in other Dominions, and in the United States of America.

The report of the Dairy Research Institute refers to continued work on problems designed to reduce the damage done through bacteriophage entry into both single strain and mixed strain starters used in cheese factories, as well as on the control of cheese mites, for which purpose ethyl bromide proved a satisfactory fumigant without detriment to the flavour of the treated cheese. Dried butter fat has also been produced. Under the Food Cold Storage Research Committee, work has continued on the refrigerated gas storage of apples, the effect of fertilizers on cold-storage quality, and on the orchard storage of apples. Other work under the Fruit Research Advisory Committee included long-term manurial investigations on apples, minor element studies and further successful trials with modifications of the normal spray programmes.

The Leather Research Association has commenced an investigation on the flexibility of sole leather. The Shoe Research Association has also been concerned with investigations on adhesives. The Cawthron Institute has continued investigations on the mineral content of pastures, while among the activities of the Mineral Resources Committee may be mentioned those on refractories and oil shale, and the preparation for publication of a full report on the geological survey of Chatham Island peat deposits and the chemical investigation of the wax. The Wool Manufacturers' Research Association has given much time to the introduction of the wet chlorine process of producing unshrinkable woollen garments, and to the examination of new unshrinkable processes, as well as to the influence of hairiness on processing.

Under the Plant Research Bureau the Agronomy Division has continued its investigations on linen flax, including the mite infestation of flax seed in store, for which purpose a dressing of 'Ceresan' has given good protection. The Botany Division, Wellington, has continued work on seaweed utilization, medicinal plants, rubber plants, and fibre plants. Good progress has been made during the year in the establishment of hard-wearing turfs for aerodromes, while the Plant Diseases Division has continued its work on vegetable diseases and pests, particularly the control of the carrot rust fly, late blight of tomatoes, and downy mildew of onions. Under the Timber Protection Research Committee the State Advances Corporation has continued field investigations of timber-infesting insects and fungi, the field application of termite control and the field application of wood preservatives.

The report also includes a summary of the more important results emerging from the 1942–43 season's work of the Tobacco Research Advisory Committee. Entomological investigations at the Canterbury Agricultural College have included sheep-dipping experiments and work on insect pests of wheat and of cocksfoot. Animal production research has included studies of the nutritive value of New Zealand mutton and lamb, and the preparation of hormones. Work at the Wool Metrological Laboratory has been considerably curtailed, but the analysis of survey data collected during 1941–42 has been continued. The Massey Agricultural College has continued its experiments on sheep nutrition, drainage research, root development studies, and on sheep-breeding methods, as well as on pig research.

The report of the Dominion Physical Laboratory refers to investigations on pyrometric control, the chromium plating of gauges and tools, surface metallizing of mirrors, high-speed cross-bearings, measurement of low illumination, repair of lightning arresters, mould on wallboard, and on physical problems in the linen flax industry.

RESEARCHES ON PENICILLIN

So much has been written about penicillin, the bacteriostatic substance extracted from *Penicillium notatum*, that one hesitates to add more at a time when its properties, which are so remarkable that they seem to be almost magical, are still being investigated in Great Britain and elsewhere. It is clear that everything possible is being done to make this beneficent substance available in quantities as large as possible and to investigate to the full its possibilities.

E. Chain, H. W. Florey, M. A. Jennings and T. I. Williams (*Brit. J. Exp. Path.*, **24**, 108; 1943), working in Oxford, where already so much pioneer work on penicillin has been done, have continued the work of W. H. Wilkins and G. C. M. Harris (*Brit. J. Exp. Path.*, **23**, 166; 1943) and report the isolation in a crystalline state of helvolic acid, which, like penicillin, is especially active against Gram-positive organisms and is chiefly bacteriostatic rather than bactericidal. It is soluble in most organic solvents, but is insoluble in water, although its sodium salt is readily water-soluble. Leucocytes are not affected by dilutions of it of more than 1 : 1,600 and tissue cultures can be exposed to dilutions of 1 : 2,500 for forty-eight hours. It is excreted in the urine and bile. A high antibacterial titre can be maintained in the blood, but repeated injections of it damage the liver.

Another worker is briefly noted in the *Journal of the American Veterinary Medical Association* (102 385; 1943). The only reference given to the source of this note is that it is abstracted from *Science Digest* of an unstated date. The reference is to a substance which has been called 'penatin', discovered by W. Kocholaty at the University of Pennsylvania. It is claimed that penatin has an even higher 'microbicidal' power than penicillin (penicillin does not kill bacteria; it inhibits their multiplication) and a wider range of application. It is claimed that "50 pathogenic and non-pathogenic species yielded to its action in dilutions as high as 1 : 400,000,000". Anthrax, diphtheria, typhoid, paratyphoid, brucellosis, pneumonia and pus-forming micro-organisms were 'killed' with dilutions of 1 : 12,500,000. Its action was not lowered in 90 per cent serum, and rabbits and guinea pigs suffered no obvious ill-effects from "large intravenous injections".

Readers who wish for further references to the properties of penicillin will find useful the article by M. E. Florey and H. W. Florey (*Lancet*, 387; March 27, 1943) on its general and local administration and the leading article in the *Lancet* (106; July 24, 1943) entitled "Penicillin in America". The latter article gives further references. J. Mackintosh and F. R.

Selbie (*Lancet*, 793; June 26, 1943) compare the action of penicillin with that of some of the sulphonamides and compounds of the flavine type on anærobic infections of wounds, and a leading article in the *Lancet* (78; June 19, 1943) discusses the evaluation of wound antiseptics, with further reference to the literature of this subject. Sir Henry Dale, in his Frederick Price Lecture (*Brit. Med. J.*, 411; Oct. 2, 1943), briefly deals with penicillin and with the training, by cultural restriction, of a soil bacillus to produce gramicidin, which acts chiefly on Gram-positive cocci. It is clear that the Gram-positive organisms especially, and a good many others as well, are in for a pretty bad time in the years ahead.

Since this note was written the following important further articles on penicillin have appeared: "Progress with Penicillin" (*Lancet*, 546; Oct. 30, 1943); "Penicillin in the U.S.A." (*Brit. Med. J.*, 582; Nov. 6, 1943), both of which deal with American work, and the interesting paper by G. J. Harper (*Lancet*, 569; Nov. 6, 1943) on the destruction of penicillin by the penicillinase produced by certain bacteria.

WOOD UTILIZATION

THE Utilisation Branch of the Forest Research Institute at Dehra Dun, India, continues its issue of practical war research investigations in the Bulletin and Leaflet series of the Institution's publications. *Ind. For. Bulletin* No. 118 (For. Res. Inst., Dehra Dun, published 1943) discusses "Studies in Fire Resistance" of some Indian timbers. Experiments have been carried out on the rate of burning of fifty-two species of Indian timbers, and the influence of various factors like the structure of the wood, physical properties and so forth on the natural fire-resistance of wood is discussed by the writers of the bulletin, D. Narayanamurti and R. Gopalachari. In the present time when the public have come to regard iron and concrete as the chief materials in building construction, it may cause surprise to read the following recorded opinion of the investigators. It merits consideration and further investigation, when in Great Britain there is so much rebuilding and new building to be undertaken.

Wood, despite its many favourable properties, is held by many to be less valuable than iron or concrete because of its inflammability. Combustibility is not always the only criterion to be considered in a material of construction, and even when it is important careful investigation shows that wood behaves better than the other materials when exposed to fierce fires. Natural stones burst even on slight warming, and iron even at 500° C. loses half its strength. The loss of elasticity in heated iron leads to changes of form and shape so that sudden collapse without warning is unavoidable. With wood, in the early stages of fire, any small loss of strength due to the surface burning is compensated for by a loss in moisture content which increases its strength. Another defect of iron is its high thermal conductivity, which is more than two hundred times that of wood. For fire-fighting services also a wooden structure is less dangerous, and the clearing up of wooden wreckage is also easy. By proper methods of construction and suitable chemical treatment wood can be made very fire-resistant. The bulletin is written mainly for India; but the position of wood *vis-à-vis* iron and concrete is well worth a close consideration in the great building schemes facing Britain.

In *Ind. For. Leaflet* No. 42 (Res. Inst. Press, 1943) on "Preliminary Studies on Improved Wood", by D. Narayanamurti and Kartar Singh, the importance of wood from time immemorial for construction and fabrication is noted. 'Availability' and 'low cost' are two of the reasons given. In some parts of the world, however, neither of these statements is correct, notably in Britain. The leaflet discusses the results of experiments to improve the properties, in other words the resistance, of wood by impregnation with synthetic resins and other materials. Impregnation with resins is found to increase the density and compressive strength. Under suitable conditions it is possible to increase the compressive strength per unit specific gravity considerably—but attention is directed to the limitations of the process.

An *Indian Forest Leaflet* (No. 37; 1943), "How to Identify Timbers", Part 3, is a continuation of this subject. The author, K. A. Chowdhury, states that Part 1 of the series should be read in conjunction with the present one. The importance of the investigations dealt with in Part 3 lies in the fact that the timbers investigated in the Wood Technology Section have been those thought to be most suitable for motor-lorry bodies. It is well known that in the provision of equipment for the great armies in India that country has become inevitably more and more self-supporting. The leaflet gives a key for the field identification of important Indian timbers used for motor-lorry bodies. Short anatomical descriptions of these timbers have also been included. The importance of this type of information available to the local forest officer in the field is scarcely realizable to the layman. But anyone who has examined a great raft of logs consisting of the whole boles of the trees after floating down several hundred miles of a tropical river, with the object of identifying the botanical species of the logs, will have little difficulty in appraising the importance of this type of research.

PHYSIOLOGICAL BASIS OF CAMOUFLAGE

THE methods of camouflage and of reconnaissance in modern warfare are, to a great extent, conditioned, and even limited, by the potentialities of our visual and acoustic perceptions. Military experts are little acquainted with the scientific side of the problem of human senses and perceptions, while physiologists and psychologists have not yet paid sufficient attention to the application of their knowledge to the evaluation of the 'human factor' in war.

The recently created laboratory for the study of perceptions at the Institute of Psychology of the University of Moscow has, therefore, commenced the publication of a series of books and pamphlets on perception, observation, memory, emotions, etc., under war conditions, and the first booklet, by Prof. K. Kh. Kukcheev, deals with the psychophysiology of camouflage and of reconnaissance.

Detailed scientific data are given on such subjects as the sensitiveness of contrast vision; stereoscopic vision; estimation of distances; perception of movement of different velocity; colour vision; visual perception at low light intensities in connexion with night reconnaissance; physiology of sound perception; sound 'camouflage'; tactile perception

and training for 'blind' action; olfactory perception and 'camouflage' of poison gases by other substances; etc. On every point, physiological facts and principles are briefly presented and illustrated by examples likely to be met on the battlefield.

The booklet is, apparently, not intended for immediate practical use; but rather to supply camouflage experts with the necessary data of physiological order.

FORTHCOMING EVENTS

*(Meetings marked with an asterisk * are open to the public)*

Saturday, November 20

BRITISH RHEOLOGISTS' CLUB (at the Royal Society of Arts, John Adam Street, Adelphi, London, W.C.2), at 2 p.m.—Commander C. F. Goodeve, F.R.S.: "Rheology and Naval Problems".

Monday, November 22

ROYAL SOCIETY OF ARTS (at John Adam Street, Adelphi, London, W.C.2), at 1.45 p.m.—Mr. W. A. Robertson: "Timber—the New Outlook" (Cantor Lectures, 1).

Tuesday, November 23

ROYAL ANTHROPOLOGICAL INSTITUTE (at the Royal Society, Burlington House, Piccadilly, London, W.1), at 1.30 p.m.—Prof. F. C. Bartlett, F.R.S.: "Anthropology in Reconstruction".

INSTITUTION OF BRITISH AGRICULTURAL ENGINEERS (at the Royal Society of Arts, John Adam Street, Adelphi, London, W.C.2), at 1.45 p.m.—Mr. S. S. McKay: "Mechanization in Farming".

ROYAL SOCIETY OF MEDICINE (at 1 Wimpole Street, London, W.1), at 4.15 p.m.—Discussion on "The State of Nutrition in Enemy-Occupied Europe" (to be opened by Colonel W. E. Vignal and Dr. A. P. Cawadias).

CHADWICK PUBLIC LECTURE (at St. Mary's Hospital Medical School, Norfolk Place, Praed Street, London, W.2), at 4.30 p.m.—Sir Harold Morris: "Sir Malcolm Morris, Dermatologist—Some Personal Reminiscences" (Malcolm Morris Memorial Lecture).*

INSTITUTION OF CIVIL ENGINEERS (at Great George Street, Westminster, London, S.W.1), at 5 p.m.—Mr. B. D. Richards: "Post-War Transport in Great Britain".

ROYAL INSTITUTION (at 21 Albemarle Street, London, W.1), at 5.15 p.m.—Prof. J. C. Drummond: "Food Problems of the Post-War Years", 1: "Food Production".*

Wednesday, November 24

ROYAL SOCIETY OF ARTS (at John Adam Street, Adelphi, London, W.C.2), at 1.45 p.m.—Dr. J. G. Davis: "Cheesemaking".

INSTITUTION OF ELECTRICAL ENGINEERS (WIRELESS SECTION) (at Savoy Place, Victoria Embankment, London, W.C.2), at 5.30 p.m.—Mr. C. P. Edwards: "Enemy Airborne Radio Equipment" (with demonstration of equipment).

Thursday, November 25

ROYAL INSTITUTION (at 21 Albemarle Street, London, W.1), at 2.30 p.m.—Prof. W. Perceval Yetts: "Links between Ancient China and the West: a Study of Exchanges in Material Culture", 1: "Roads to the West".*

INSTITUTE OF FUEL (in the Engineers' Club, Albert Square, Manchester), at 3 p.m.—Dr. E. W. Smith: "The Aims and Objects of the Institute in relation to the National Fuel Position".

INSTITUTION OF ELECTRICAL ENGINEERS (at Savoy Place, Victoria Embankment, London, W.C.2), at 3 p.m.—Dr. A. P. M. Fleming: Lecture to commemorate the Life and Work of Nikola Tesla (illustrated by examples of Tesla's experimental work).

BRITISH INSTITUTION OF RADIO ENGINEERS (LONDON SECTION) (at the Institution of Structural Engineers, 11 Upper Belgrave Street, London, S.W.1), at 6.30 p.m.—Mr. M. M. Levy: "Stabilizing Electronic Circuits".

Friday, November 26

PHYSICAL SOCIETY (in the Physics Department of the Imperial College, Imperial Institute Road, South Kensington, London, S.W.7), at 4.30 p.m.—Dr. H. T. Flint: "A Survey of Nuclear Field Theories".

ROYAL INSTITUTION (at 21 Albemarle Street, London, W.1), at 5 p.m.—Sir Joseph Barcroft, F.R.S.: "The Preservation of Foods by Drying".

APPOINTMENTS VACANT

APPLICATIONS are invited for the following appointments on or before the dates mentioned:

ADVISER IN AGRICULTURAL CHEMISTRY—The Registrar, The University, Manchester 13 (November 23).

TECHNICAL ASSISTANT (second) in the Economics Department—The Secretary, West of Scotland Agricultural College, 6 Blythswood Square, Glasgow (November 24).

LECTURER (full-time) IN THE DEPARTMENT OF AERONAUTICAL ENGINEERING—The Registrar, Loughborough College, Loughborough, Leics. (November 27).

INSTRUCTOR (full-time) IN PLUMBING in the School of Building, East Ham Technical College—The Secretary for Education, Education Office, Town Hall Annexe, Barking Road, East Ham, London, E.6 (November 27).

LECTURER (part-time) ON WORKS ORGANIZATION AND MANAGEMENT—The Principal, West Ham Municipal College, Romford Road, Stratford, London, E.15 (November 29).

CHIEF TECHNICAL OFFICER—The Secretary, Warwickshire War Agricultural Executive Committee, 6 Guy's Cliffe Avenue, Leamington Spa (November 30).

PSYCHOLOGIST (with an Honours Degree in Psychology, experience of testing, remedial teaching, and preferably child guidance work)—The Medical Superintendent, Central Mental Hospital, near Warwick (December 4).

DEMONSTRATOR (temporary, full-time) IN BIOLOGY—The Dean, St. Bartholomew's Hospital Medical College, London, E.C.1 (December 7).

DEMONSTRATOR (man or woman) IN THE CHEMISTRY DEPARTMENT—The Warden and Secretary, London (Royal Free Hospital) School of Medicine for Women, 8 Hunter Street, Brunswick Square, London, W.C.1 (December 10).

CITY ENGINEER AND SURVEYOR—The Town Clerk, Town Clerk's Office, St. Albans (endorsed 'City Engineer') (December 10).

FULL-TIME LECTURER (temporary) IN THE DEPARTMENT OF ELECTRICAL ENGINEERING—The Principal, Borough Polytechnic, Borough Road, London, S.E.1.

LECTURER IN ELECTRICAL ENGINEERING—The Registrar, Merchant Venturers' Technical College, Bristol 1.

HYDROGRAPHICAL SURVEYORS for the Basrah Port Directorate, Iraq—The Ministry of Labour and National Service, Appointments Department, Sardinia Street, Kingsway, London, W.C.2 (quoting Reference No. O.4962.8).

PROFESSOR OF PHYSICS, a PROFESSOR OF GEOLOGY AND MINERALOGY, and a SENIOR LECTURER IN BIOCHEMISTRY, in the University of Melbourne—The Secretary, Universities Bureau of the British Empire, c/o University College, Gower Street, London, W.C.1.

QUALIFIED METALLURGISTS for interesting work connected with Powder Metallurgy—The Ministry of Labour and National Service, Central (Technical and Scientific) Register, Alexandra House, Kingsway, London, W.C.2 (quoting Reference No. O.N.F.1212.X).

ASSISTANT MASTER (GRADUATE) FOR MATHEMATICS, SCIENCE AND DRAWING, in the Junior Technical School for Boys—The Director of Education, 8 Warrington Street, Ashton-under-Lyne, Lancs.

METALWORK INSTRUCTOR—The Principal, South Dorset Technical College, Newstead Road, Weymouth.

ASSISTANT IN THE BIOCHEMICAL DEPARTMENT—The Medical Superintendent, Dudley Road Hospital, Birmingham 18.

ASSISTANT METALLURGICAL CHEMIST for the Works Laboratory of an important Engineering Works near London engaged on highest priority Government work—The Ministry of Labour and National Service, Central (Technical and Scientific) Register, Alexandra House, Kingsway, London, W.C.2 (quoting Reference No. O.N.F.1666.X).

ENGINEER in the Directorate of War Production, Government of Palestine, and an ENGINEER in the Department of Heavy Industries, Government of Palestine—The Ministry of Labour and National Service, Central (Technical and Scientific) Register, Alexandra House, Kingsway, London, W.C.2 (quoting Reference No. E.804.A).

REPORTS and other PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

Experimental and Research Station, Nursery and Market Garden Industries' Development Society, Ltd. Twenty-eighth Annual Report, 1942. Pp. 78. (Cheshunt: Nursery and Market Garden Industries' Development Society, Ltd.) [219

Ministry of Fuel and Power. Twenty-first Annual Report of the Safety in Mines Research Board, 1942. Pp. 23. (London: H.M. Stationery Office.) 1s. net. [1810

Forward—by the Right! A Statement by the Tory Reform Committee. Pp. ii+16. (London: Tory Reform Committee.) [1810

A List of 16 mm. Scientific Films including Mathematics, Physical Science and Biology. No. 14, revised. Pp. 36. (London: British Film Institute.) 2s. [1810

Other Countries

South African Institute for Medical Research, Johannesburg. Annual Report for the Year 1942. Pp. 51. (Johannesburg: South African Institute for Medical Research.) [219

Bulletin of the Geological Society of America. Vol. 54, Paper No. 82: Meteorites and an Earth-Model. By Reginald A. Daly. Pp. 401-456. (New York: Geological Society of America.) [219

University of Cape Town. Communications from the School of African Studies, New Series, No. 8: The Bored Stones of Southern Africa. Part 4: A. Cape of Good Hope; B. Elongated Types. By A. J. H. Goodwin. Pp. ii+24. (Cape Town: University of Cape Town.) 2s. [219

Lucknow University Studies. No. 17: The Cretaceous Rocks of South India. By Prof. L. Rama Rao. Pp. v+81+3 plates. (Lucknow: Lucknow University.) [219

Indian Forest Leaflet. No. 42 (Utilisation): Preliminary Studies on Improved Wood. Part 1: A Study of the Impregnation of Wood with Resins. By D. Narayanamurti and Kartar Singh. Pp. 16. (Dehra Dun: Forest Research Institute.) 6 annas; 9d. [219

Indian Forest Records, New Series. Utilisation, Vol. 2, No. 2: Bamboo Nails, their Manufacture and Holding Power. By V. D. Limaye. Pp. 12+3 plates. (Dehra Dun: Forest Research Institute.) 6 annas; 9d. [219

Catalogue

A Catalogue of Rare Books on Early Medicine and Surgery. (No. 614.) Pp. 24. (London: Bernard Quaritch, Ltd.)